The Tool Engineer

FEBRUARY 1954

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

FINISHES FOR METALS

Cover: Symbolic of metal finishing, this month's cover portrays artist William Solms' conception of a modern method, electrostatic spraying that provides a beautiful finish without waste, water curtains or special ventilation. The characteristics of inorganic and protective coatings are discussed on page 81.

The Tool Engineer

Volume XXXII, No. 2 February, 1954

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ASTE

PLANNING · ENGINEERING · CONTROL · TOOLING · EQUIPMENT · PRODUCTION

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The Tool Engineer

Safety Breeds Caution

Because of human nature, workers grow callous in the face of occupational hazards. Like the holiday driver, unmindful of the lethal potentialities of his car, the worker may be careless for one moment but injured seriously for life. Hazards are always present, waiting for that unguarded instant. Knowing human frailties, the tool engineer imposes positive measures of safety wherever possible. More and more frequently, operators load a feeding mechanism or an indexing station at some point removed from the work area. In addition, the work area is often protected by guards in such a way that the machine becomes inoperative if any foreign object enters the area.

Much of the recent progress in automation stems from the search of safety engineers for better and more foolproof methods for reducing hazards. The dividends of better control over quality and reduced costs of finished parts have accelerated many safety programs and saved money for additional safety improvements.

The contempt of a worker for hazards with which he has become familiar is not something new. It has been recognized over a century, and it is the responsibility of the safety engineer to protect a worker against himself, even against his will. Reported in 1842 in *Manufactures in Metal*, the following could be true today except for the manner of expression.

"In consequence . . . needle grinding is found to be an employment extremely prejudicial to health. Various devices have been adopted for diminishing the evil such as hanging a cloth over the stone, wearing damped gauze over the mouth or by placing a magnetic gauze over the face. . . . Needle pointers manifestly exhibit rather a reluctance than a forwardness to adopt any preventive which seems to be an encumbrance. . . . 'Because', say they, 'if our work were less injurious, our masters would reduce the prices of grinding.' "

Because habits and propensity for carelessness in workers have not changed, an effective safety program must be "double-barreled", including education in addition to foolproof safety measures that do not seem to handicap or inconvenience the operator.

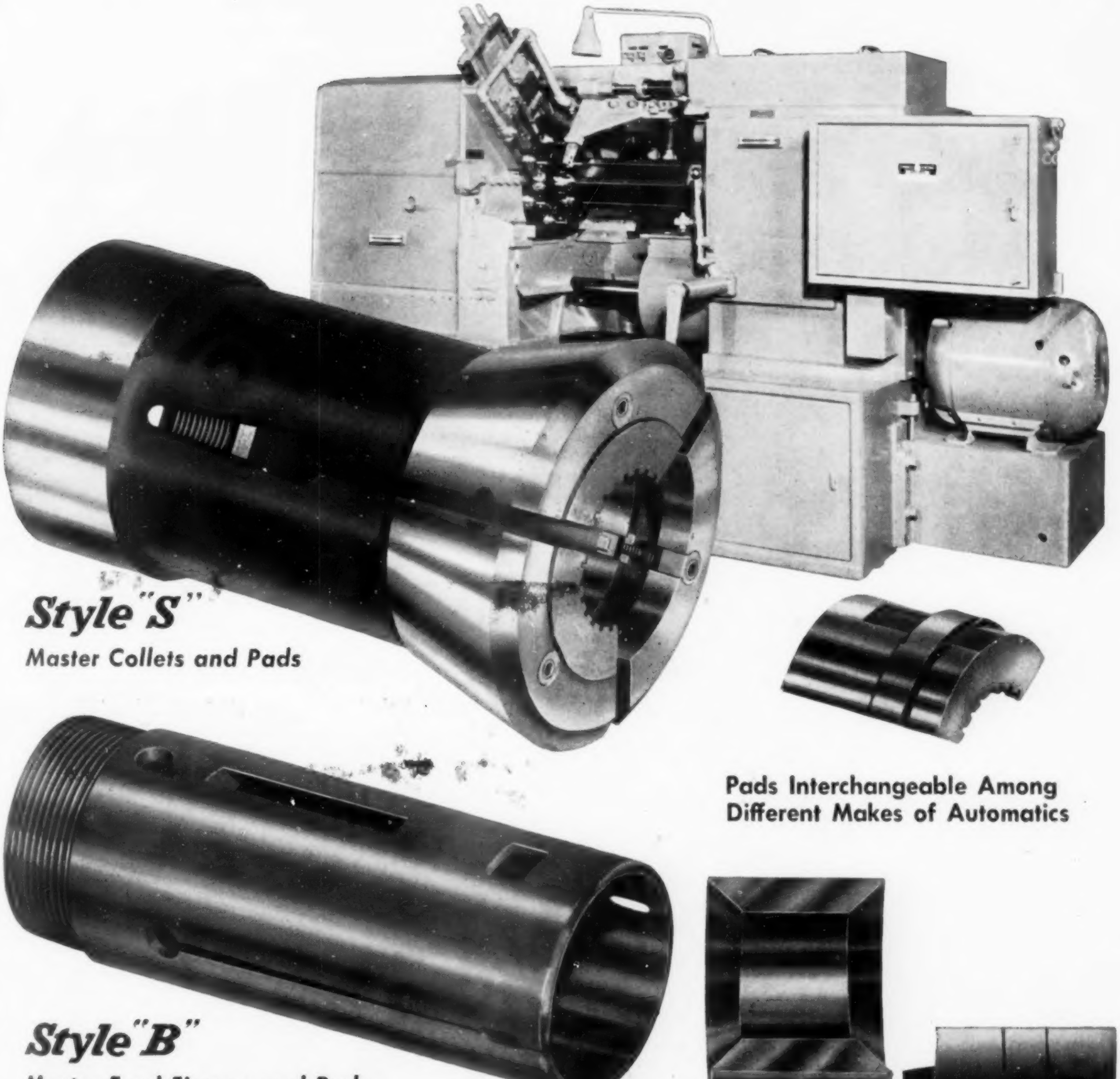
John W Greve
EDITOR

HARDINGE ELMIRA, N.Y.

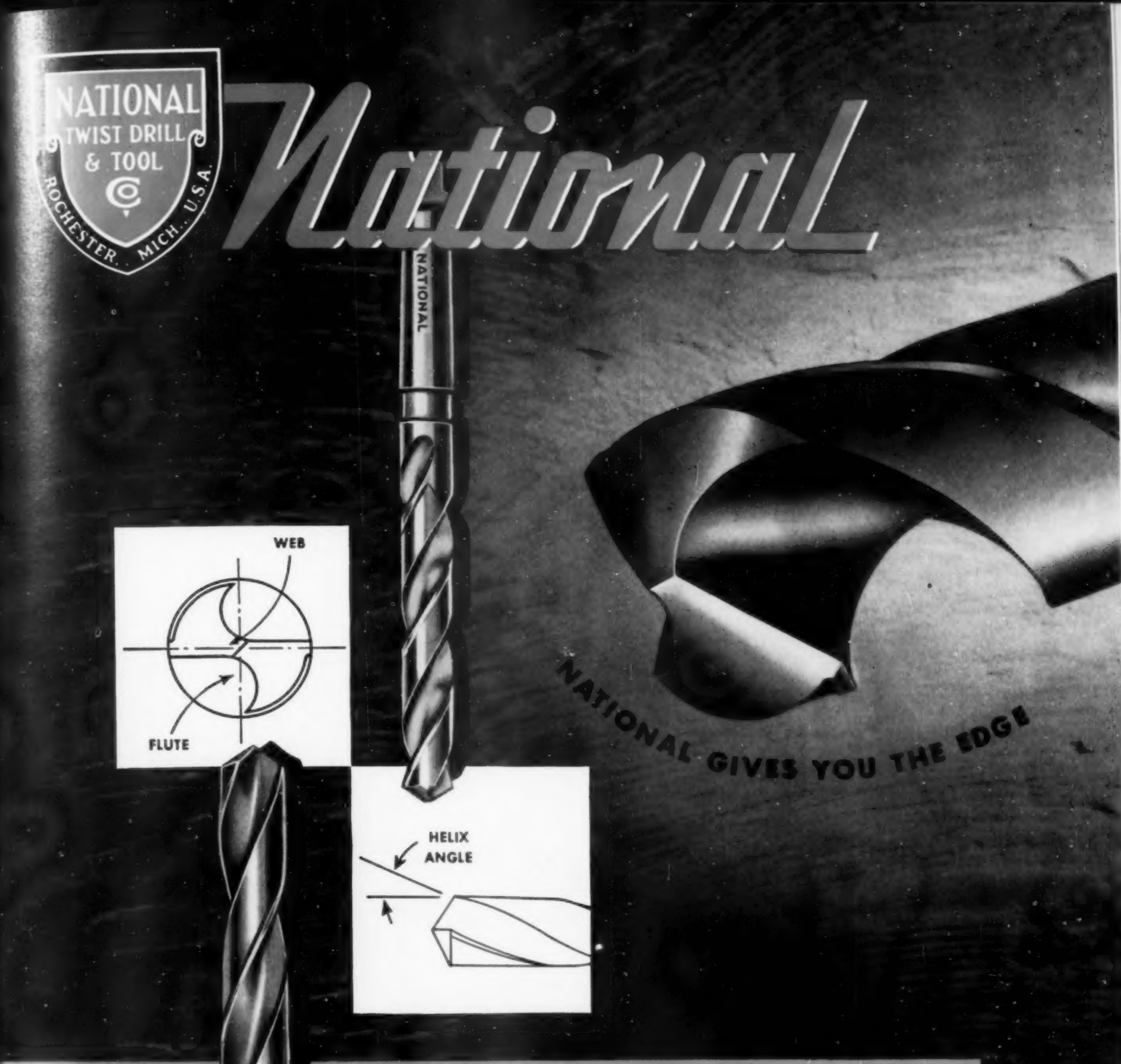
STANDARD EQUIPMENT

in Progressive Screw Machine Plants

The Only Master With NO Work Pressure On The Screw



HARDINGE BROTHERS, INC., ELMIRA, N. Y.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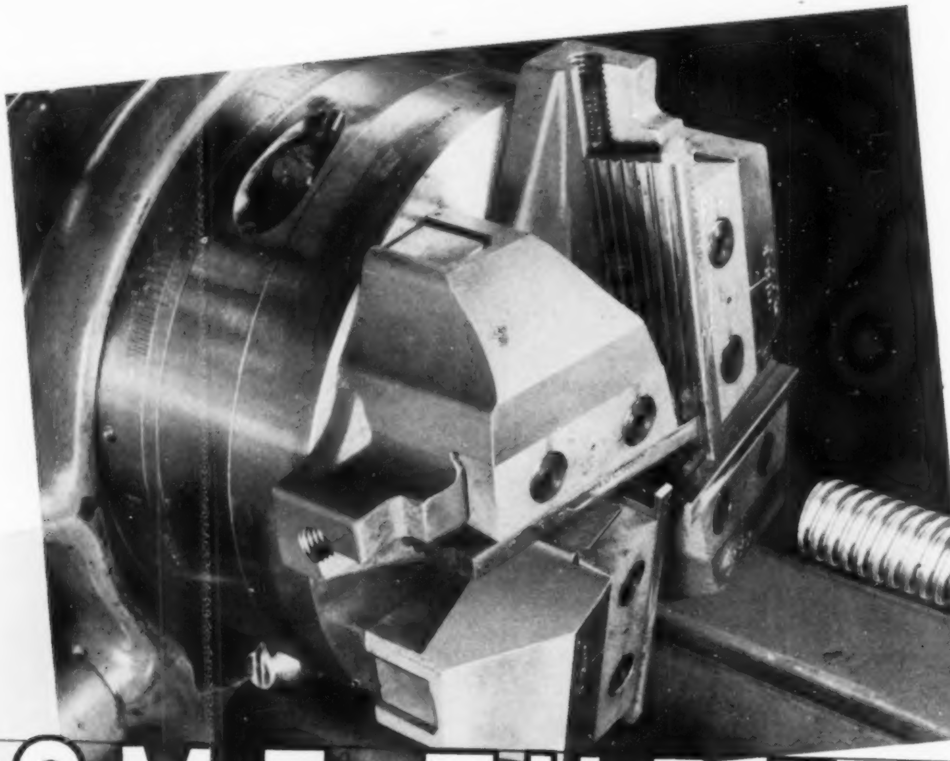
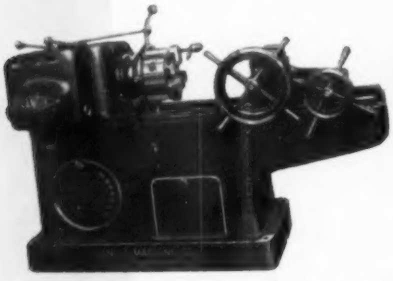




All we did was to ask a simple question . . .

and E. J. Bowe *said* **"I have no complaints!"**

We wanted to know how Ed was getting along with his battery of 8 of our No. 7 Hand Screw Machines, and the production superintendent of the well-known General R-F Fittings Co. of Boston said something we were mighty pleased to hear:

"We're in a highly competitive field, yet where quality of the part has to be of first consideration. I honestly think that without the help of the Wade No. 7 hand screw machine we never could turn out the large volume of R-F fittings that we do, and with hardly any down-time. We get no complaints from our operators, no complaints from our customers, and you'll get no complaints from me! I like these machines."

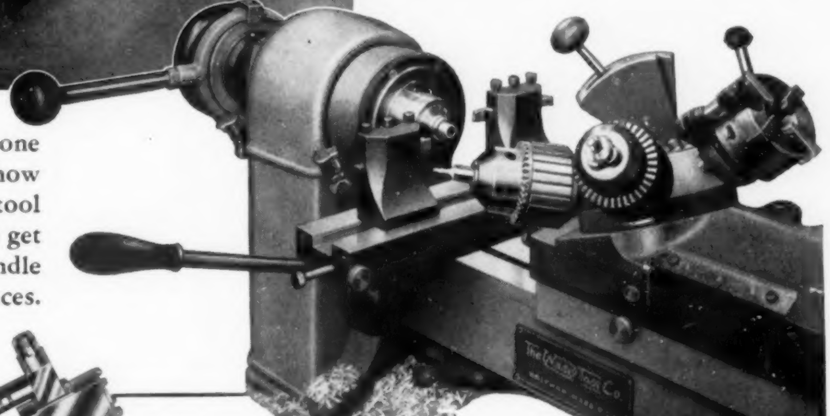
Wade no. 7

HAND SCREW MACHINES

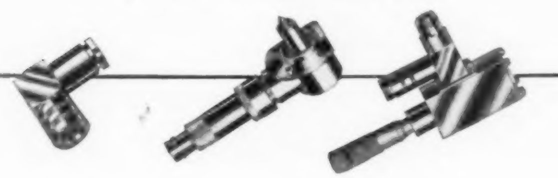
in operation at

GENERAL R-F FITTINGS CO., BOSTON

producers of standard and special co-ax connectors, cable assemblies, wavemeters, crystal mounts, dummy loads, directional couplers, and other microwave components.



Notice this efficient turret set-up for one of the *General R-F Fittings.* See how the cut-away case-hardened steel tool blocks permit the operator to get tools closer to the nose of the spindle and hold closer tolerances.



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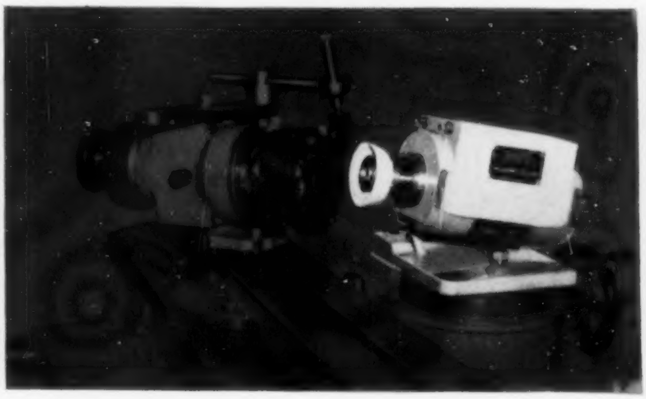
Specify THIS NEW POPE SUPER PRECISION HP, 3600 RPM MOTORIZED TOOL AND CUTTER GRINDER CLEARANCE ANGLE SWIVELLING HEAD

With Angular Adjustment In A Vertical Plane

TIME AND MONEY SAVING FEATURES:

1. Cup wheels, generally considered best for cutter grinding, can be used for practically all clearance angles on this new head.
2. Cup wheels produce a cutting edge on tools that lasts longer because it is stronger.
3. The tooth rest remains on the center line of the cutter for practically all grinding on centers or in the work head.
4. Most cutters and reamers can be ground all over with *one* set-up, using the swivelling table and Pope tilting head. The usual second and third set-ups are no longer required.
5. All clearance angles read directly in degrees from the scale provided on the head. Mistakes on clearance angles are avoided.
6. The right clearance angle is assured on tools difficult to grind, such as slab mills, taper reamers, angular cutters and form tools.
7. 3600 R.P.M. — one wheel speed — safe for all wheels generally used on cutter grinders. Heat checking of cutters is virtually eliminated.
8. The operating ease and convenience of this new Pope Head with the angular adjustment in the vertical plane saves you time and money on every tool you grind.

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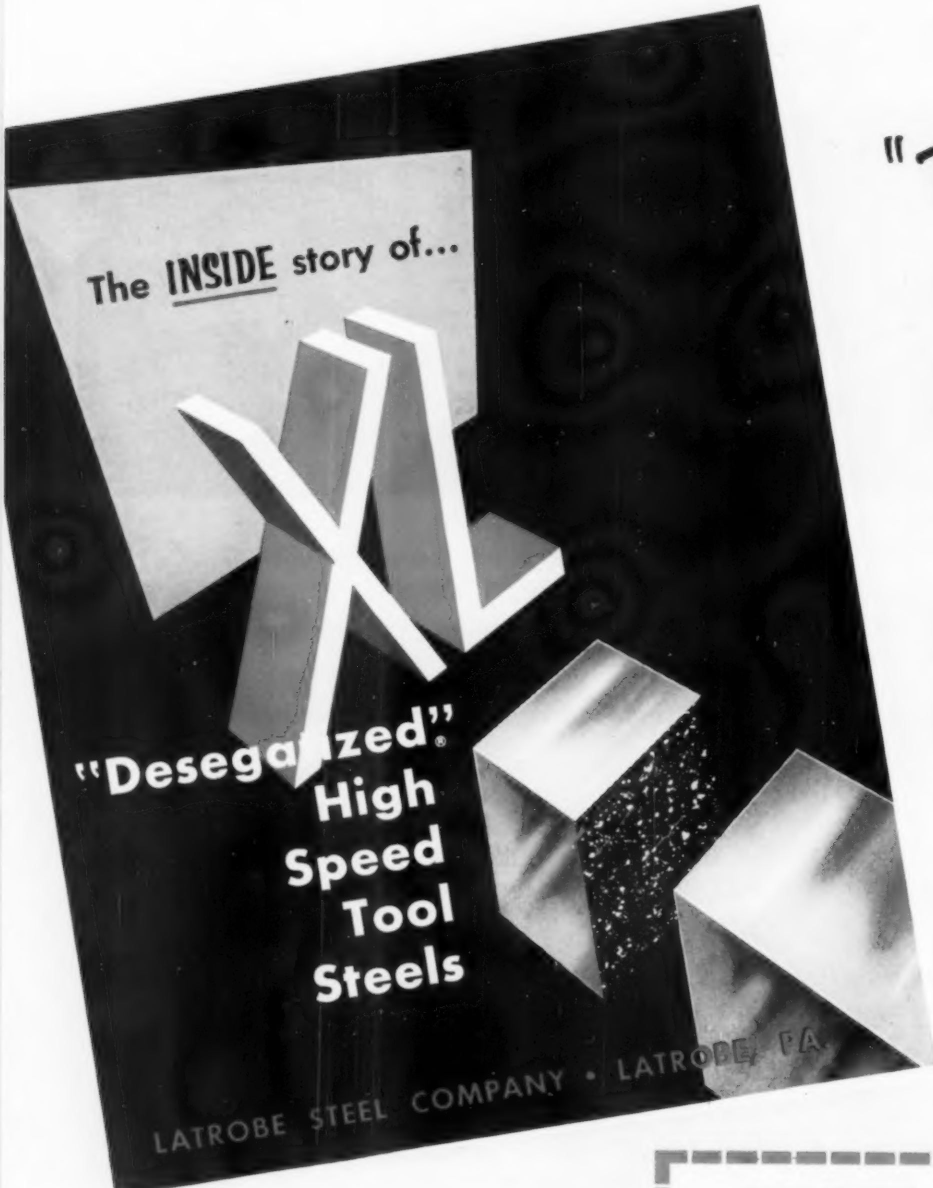

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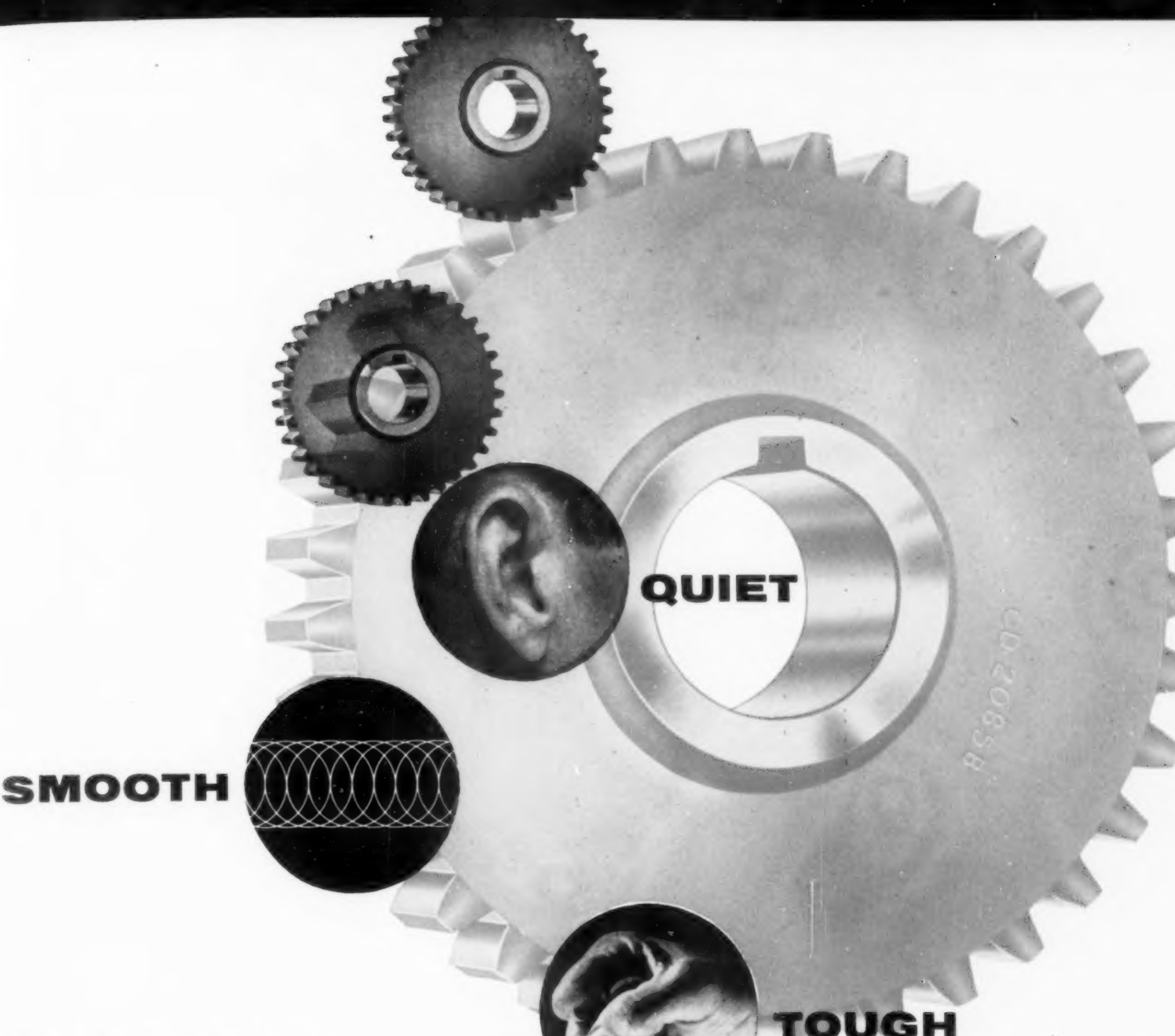
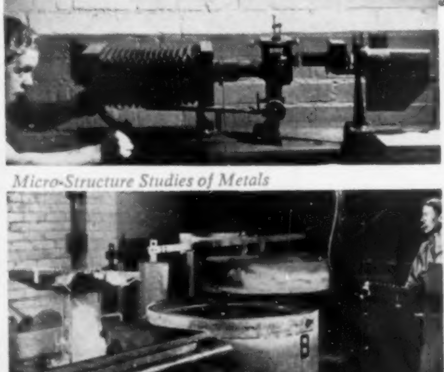


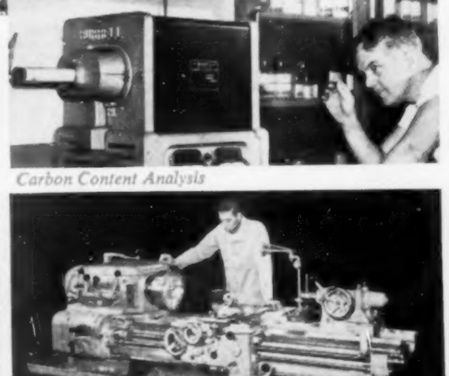
Metallurgical control at Axelson is one of the important keys to Axelson lathe quality. Take the headstock gear, for example. Heavy alloy steel, *case-hardened* the way Axelson does it, assures high resistance to wear, to shock and to surface pitting. Other hardened lathe parts include headstock shafts, headstock and tailstock spindles and carriage bedways. This is one important reason why Axelson lathes are both rugged and accurate—why they maintain their precision for long periods even under the heaviest work load. Axelson is the master of meticulous detail. Below, a few of the check points in the Metallurgy Department.

AXELSON
LATHES

Hardness Testing



Micro-Structure Studies of Metals



Carbon Content Analysis

Case Hardening

16" Precision Tool Room Lathe

AXELSON
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LOS ANGELES 58, ST. LOUIS 16, NEW YORK 7, TULSA 1

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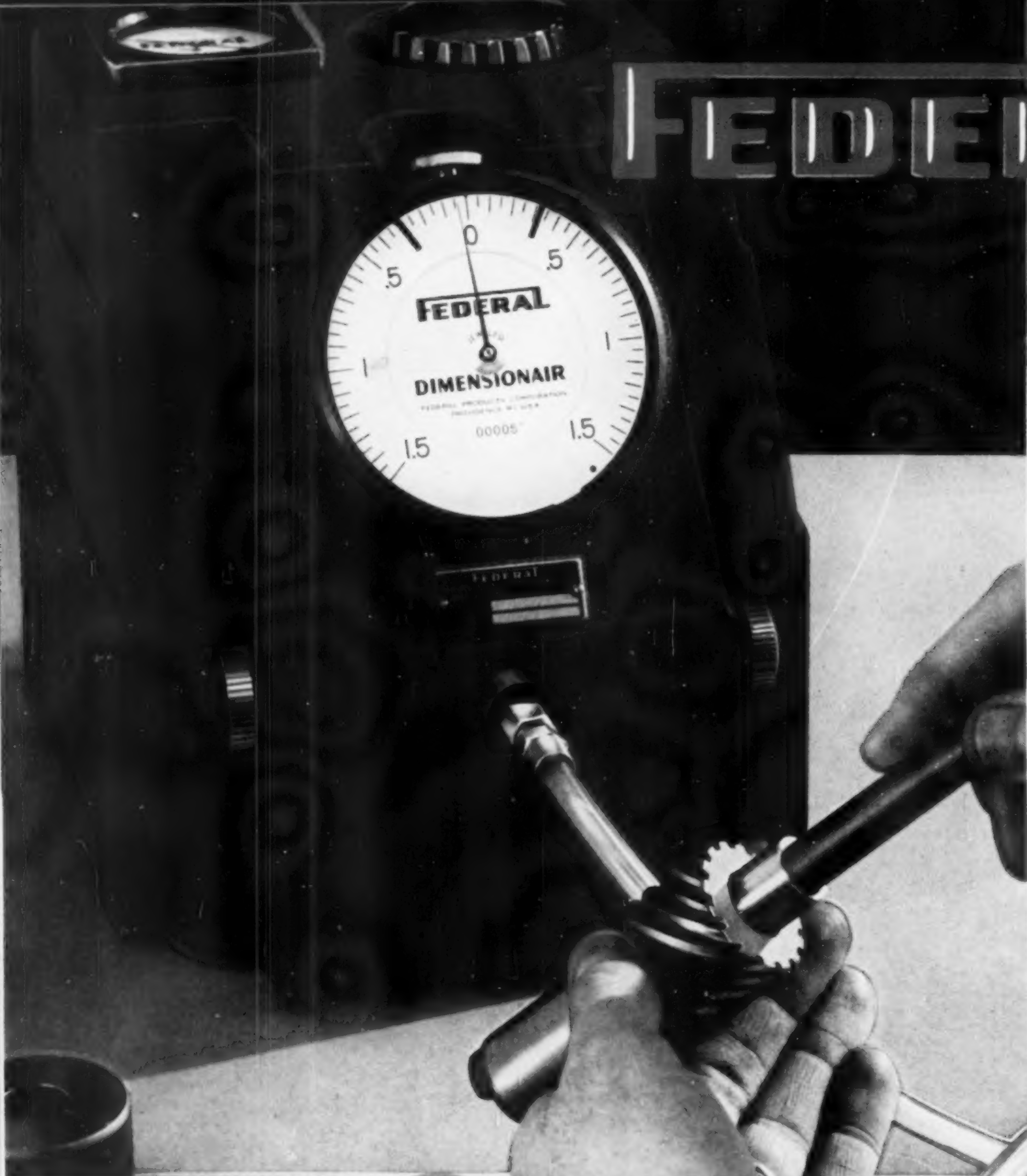
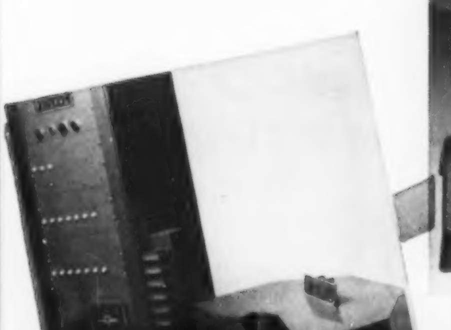
L-61

FEDERAL





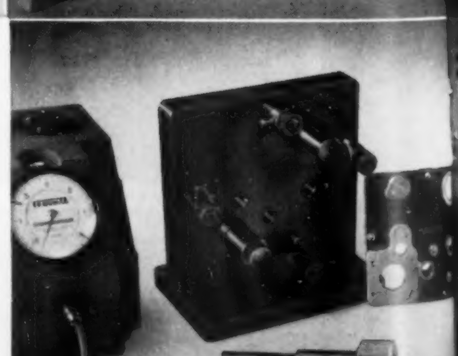
(*Above*) Explores inside diameter for taper, out-of-round and bellmouth, etc., over total length of workpiece. Dial Indicator checks distance from bottom of bore to outside shoulder.

(*Above, right*) These two six-jet air plugs gage thin-walled workpieces for average diameter. Especially applicable to work which may be distorted when fitted to its component.

AIR and ELECTRONIC

The hole is measured by air and the measurement is classified by the electronic circuit into one of 18 categories. The gage then *automatically* stamps the size on each workpiece for future identification.

Single jet air plug inspects accuracy of location of three holes in workpiece in relation to the two large locating spindles on the master fixture. An excellent gage for gear box, meter and pump housings.



DIMENSIONAIR

has *Everything* YOU NEED in an AIR GAGE

AIR SNAPS

Air Snaps are adjustable for size and made to cover all dimensions. Measuring contact is mechanical — not a jet.

Three-jet **air plug** enables accurate inspection of out-of-round holes.

THE DIMENSIONAIR IS REALLY AN OUTSTANDING AIR GAGE. Not only is it unique in its basic repetitive measuring accuracy, stability and longer range per magnification, but it is set to zero in a second and requires a minimum of maintenance. Changing plug sizes is much quicker. Resetting zero is a matter of seconds . . . no fiddling around.

Now Dimensionair, combined with electronics, is used for automatic sorting gages (See lower left illustration).

Because only a Single Master is needed with the Dimensionair, the cost of *two* masters, as required by other air gages, is cut in half. Gage at lower right required only 25 masters, instead of 50, to cover all size requirements. That's a worthwhile saving in any shop.

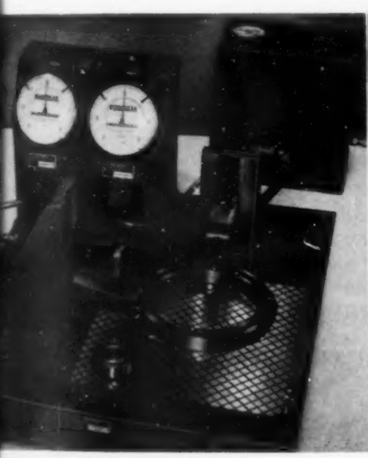
The graduated scale is accurately calibrated. It is not a scale arbitrarily divided between plus and minus tolerances. The magnification is fixed.

The gage plug has greater clearance and greater wear. The former makes it much easier to enter the plug in the hole. The plug wears much longer because the jets are set deeper; the greater range makes this possible.

Owners tell us there is no comparison after they have used various types of air gages. You really owe it to your plant to use the Dimensionair.

Federal Products Corporation, 1192 Eddy St., Providence 1, R. I.

ASK FOR OUR NEW AIR GAGE CATALOG



A Dual Dimensionair gages the inner and ...er faces of ball bearing raceways *indi...ly by mechanical contact.*

Adjustable Air Gage for fast simultaneous inspection of Ball Bearing ID & OD over a large range of 25 different sizes up to 10 inches. Checks taper, bellmouth and out-of-round. Used for *incoming inspection.* Cost of masters was cut in half because Dimensionair requires only *one* master for each size.

This new, complete catalog is full of helpful information—shows advantages and application possibilities of the modern Air Gage. Learn all about the latest in air gaging . . . ask for your copy today. Write Federal Products Corp., 1192 Eddy St., Providence 1, R. I.

FEDERAL

Largest manufacturer devoted exclusively to designing and manufacturing *all types* of DIMENSIONAL INDICATING GAGES

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Pierce metal faster, with greater accuracy and at less cost. In a single setup for multiple piercing . . . or riveting, punch extruding or trimming . . . you can reduce costly handling by combining operations into a single setup. Danly Hydraulic Metalworking Equipment is engineered to meet your specific needs. Exclusive all-hydraulic action permits smooth operation, minimizes break-through shock, automatically strips each station and simplifies fixturing. Find out more about high production multiple hole piercing in a single setup—write today for special Danly Hydraulic Metalworking Equipment Bulletin.
DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue • Chicago 50, Illinois
One setup pierces seven irregular holes and trims this car door inner window frame.
40 holes are pierced simultaneously in this automotive frame member on a Danly machine.
Irregular holes are pierced fast and accurately in this stainless steel jet engine part.

Production Pointers from GISHOLT

TIME-SAVING IDEAS

Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help you cut time and costs in your own work.

FOUND: A FAR BETTER SURFACE FINISH FOR VITAL TRANSMISSION PARTS

Superfinish Does the Job in One High-Speed, Automatic Operation

The demand for automatic transmissions in today's automobiles poses new problems in the machining and surface finishing of vital parts. Take this sun gear shaft: four separate bearing surfaces require ultra-fine finish to assure maximum life.

Superfinish proved to be the solution. A standard Model 51-A Superfinisher was modified for the job. Four quills, each with its own stoneholder and stones, were added along with a special workholder and driver.

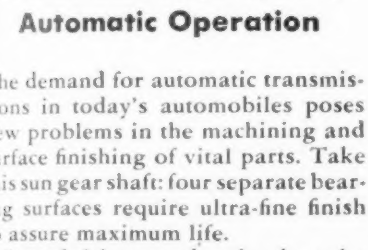
MEETS ALL 3 REQUIREMENTS

Accuracy: All four surfaces are done at once—Superfinished down to 5 micro-inches from a 15 micro-inch grind. With the automatic cycle, there is precisely the same stock removal and surface finish time after time. Superfinish rids the bearing surfaces of all annealed "smear metal" and grinding flats. Surfaces are true base metal, assuring absolute maximum bearing life.

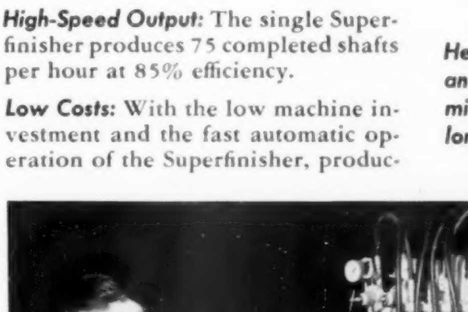
High-Speed Output: The single Superfinisher produces 75 completed shafts per hour at 85% efficiency.

Low Costs: With the low machine investment and the fast automatic operation of the Superfinisher, production costs are very low. Because Superfinishing takes the place of a final grinding operation, costs are actually lower—yet surface finish is far better and longer lasting.

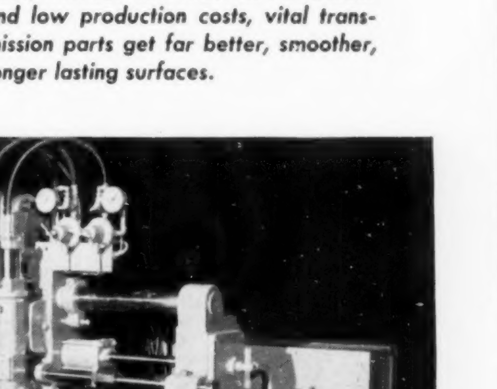
Here, with both low machine investment and low production costs, vital transmission parts get far better, smoother, longer lasting surfaces.



FACTS ON TWENTY JOBS—with photos and complete information are given in this brand-new Superfinish Catalog, just printed. The many typical applications will show how Superfinish can help you—in achieving better quality surface at low costs. Write for your copy today.



The Superfinisher is fully automatic. After loading, operator starts cycle merely by pressing a button.



Four bearing surfaces are Superfinished simultaneously at a rate of 75 pieces per hour.

MACHINE TOOLS EARN YOU MONEY

OVER-AGE MACHINE TOOLS COST YOU MONEY...

GISHOLT

TIME-SAVING IDEAS

WORKING ALL ANGLES TO CUT COSTS ON DRILL BIT BLANKS

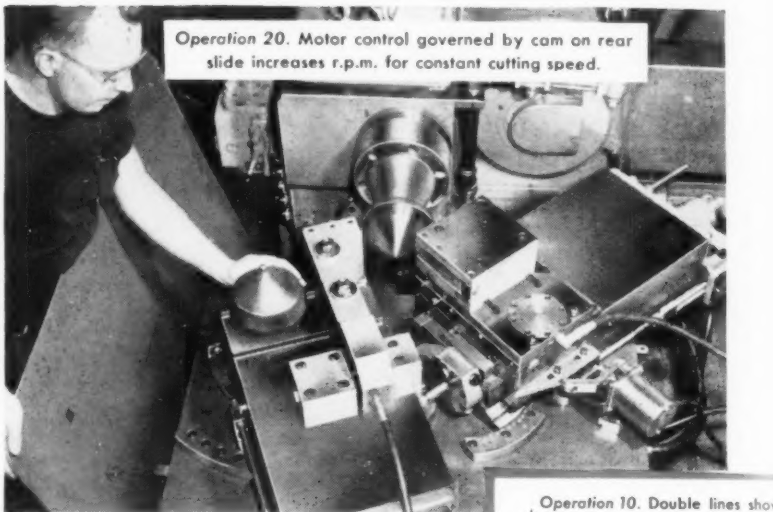
No. 12 Hydraulic Lathes Adjust Quickly for Many Different Parts and Angles

The question to be answered by this producer was how to most efficiently machine similar parts having dissimilar angles . . . and get easy changeover to other sizes. The workpieces are hard steel cone blanks; the finished products are oil well drill bits.

Because of the variety of sizes involved with each type having multiple angles, the practical solution was a pair of No. 12 Hydraulic Automatic Lathes. These are operated by one man. Changeover is simple with tool slides mounted on swivel bases.

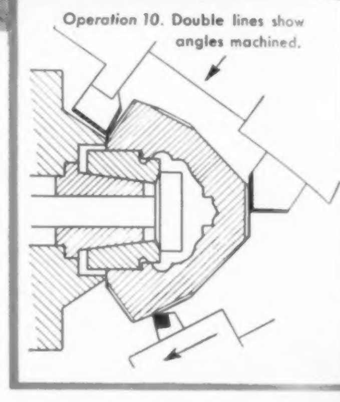
A typical setup for operation 10 is shown in the tooling layout. Both front and rear slides can be adjusted to the required angles. The work on this 6½" cone takes less than a minute and a half, f.t.f.

Operation 20 is shown in the photo. Again the front and rear slides are mounted on swivel bases. The rear slide turns the long cone, and a special motor control speeds up the spindle to give a nearly constant cutting speed as the tool approaches the cone point. A fine finish and excellent tool life is the result. The front slide turns in the conventional manner. Floor-to-floor time is just over a minute.



Operation 20. Motor control governed by cam on rear slide increases r.p.m. for constant cutting speed.

Having slides that pivot is a big time saver in changeover of the No. 12 Hydraulic Automatic Lathes to other parts with different angles.



Operation 10. Double lines show angles machined.

HOW THIS AWKWARD PART IS MACHINED WITH EASE

Note counterbalanced fixture for holding awkward part.

Unusual Job Efficiently Handled on Turret Lathe

How to handle this awkward, unbalanced part on a general-purpose turret lathe? Good planning and a 2L Saddle Type Turret Lathe provided the solution.

A special angle plate fixture with locating feet was built to hold the long rotor shaft housing. This eliminates chucking strain and insures that both bores will be round, concentric and in line. The counterweighted fixture is dynamically balanced with the workpiece to permit the high spindle speeds required for volume output and proper finish.

Tools are simple. Vertical slide tools handle all recessing, and boring bars take care of the two diameters. Time is 8.6 minutes floor-to-floor. Changeover for other size housings is simple.

★ ★ ★ ★ ★ ★ ★ ★

Doing boring and recessing on this clumsy part is a simple operation on the saddle type lathe with special holding fixture.

GISHOLT

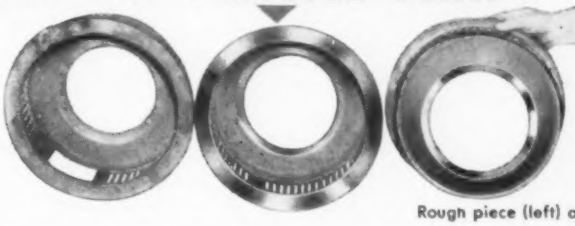
LOOK AHEAD . . . KEEP AHEAD . . . WITH GISHOLT

MODERN MACHINE TOOLS **EARN** YOU MONEY

TIME-SAVING IDEAS

GETTING A FIRM GRIP ON FRAGILE PART

Fastermatic Sets Fast Pace on Light Frame



Rough piece (left) and finished parts.

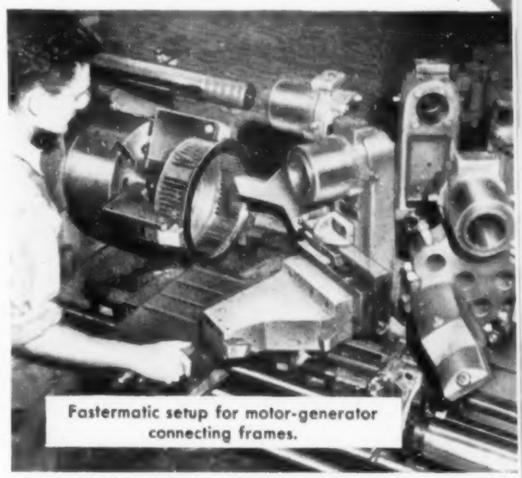
Thin-wall parts are usually a problem. But, in this case, the job is doubly tough because the workpiece is a welded assembly and has an open frame. Bores must be concentric and the faces parallel.

Devising a holding fixture was a routine matter, with Gisholt's long experience as a builder of lathes and chucks providing a "stock answer." A standard 15" 3-jaw air chuck assures speedy operation and controlled chucking pressure. Extended jaws permit pressure to be applied by rocker-type jaw ends on the front and back rings. This centers the workpiece and equalizes pressure at all points, avoiding distortion.

A 2F Fastermatic Automatic Turret Lathe handles the job. To avoid possible distortion from excessive stock removal, rough and finish cuts are made on both bores and faces. Special long tool holders carry tool bits for simultaneously machining the front and back surfaces.

The job is completed in the excellent time of only 5.5 minutes—with the automatic cycle of the Fastermatic enabling the operator to run other machines.

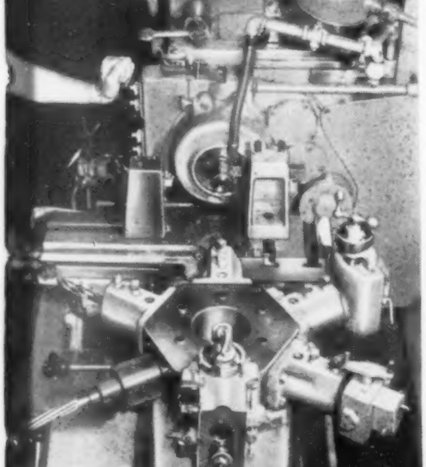
Fragile parts are quickly produced with repetitive accuracy, thanks to well-planned chucking and the automatic cycle of the Fastermatic.



Fastermatic setup for motor-generator connecting frames.

BUSINESS-LIKE SETUP FOR MACHINING BUSHINGS ON TURRET LATHE

Ram Type Machine Has Standard Hydraulically Actuated Collet Chuck and Bar Feed



Setup for efficient machining of stainless steel bushings.

Here's a fast, simple, low-cost way for machining 1¾" ring seal bushings. The job is done in a single operation on a No. 4 Ram Type Turret Lathe.

To start, the stainless steel bar stock is advanced through the spindle and held in the collet chuck. Both movement and clamping are hydraulically actuated—saving both time and effort.

The first station on the hexagon turret is a stock stop. The next two stations are used for conventional drilling and reaming. A vertical slide tool, seen in the foreground of the photo, carries a hook cutter and catches the first recess in the bore. The turning of the straight OD from the cross slide is then combined with the five-degree chamfer from the hexagon turret. The second recess in the bore is formed from the sixth station. Cut-off tool at rear of cross slide completes the operation.

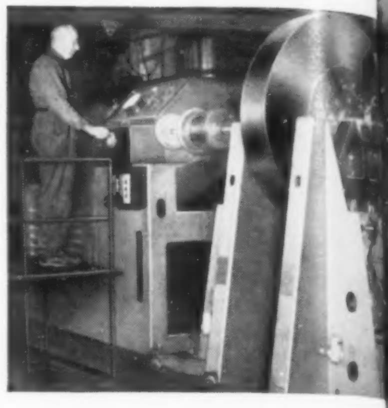
Well-planned tooling with the advance and clamping of bar stock hydraulically controlled saves time and effort on this Ram Type Turret Lathe job.

EARMARK YOUR DEPRECIATION ALLOWANCES FOR NEW MACHINE TOOLS

TIME-SAVING IDEAS

MASSIVE FLYWHEELS BALANCED FOR SMOOTH OPERATION

Direct Readings Show Unbalance Correction Required



The huge part you see here is a non-magnetic inertia flywheel for Navy Minesweepers.

The problem is to make them smooth and quiet in operation. This means precision balancing which is readily done on a Gisholt DYNETRIC Floor Type Balancing Machine.

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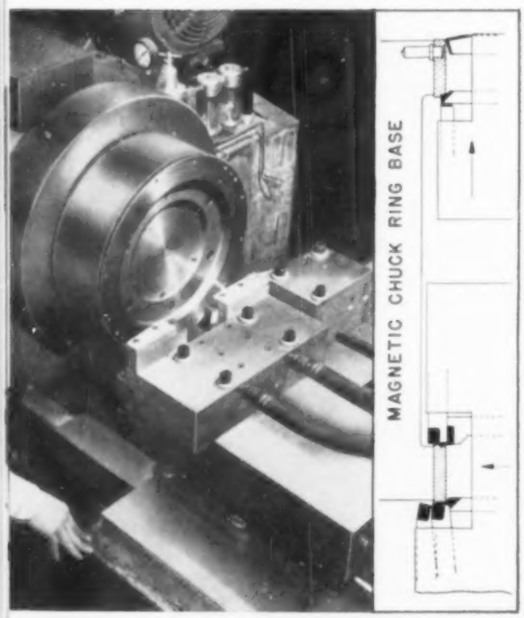

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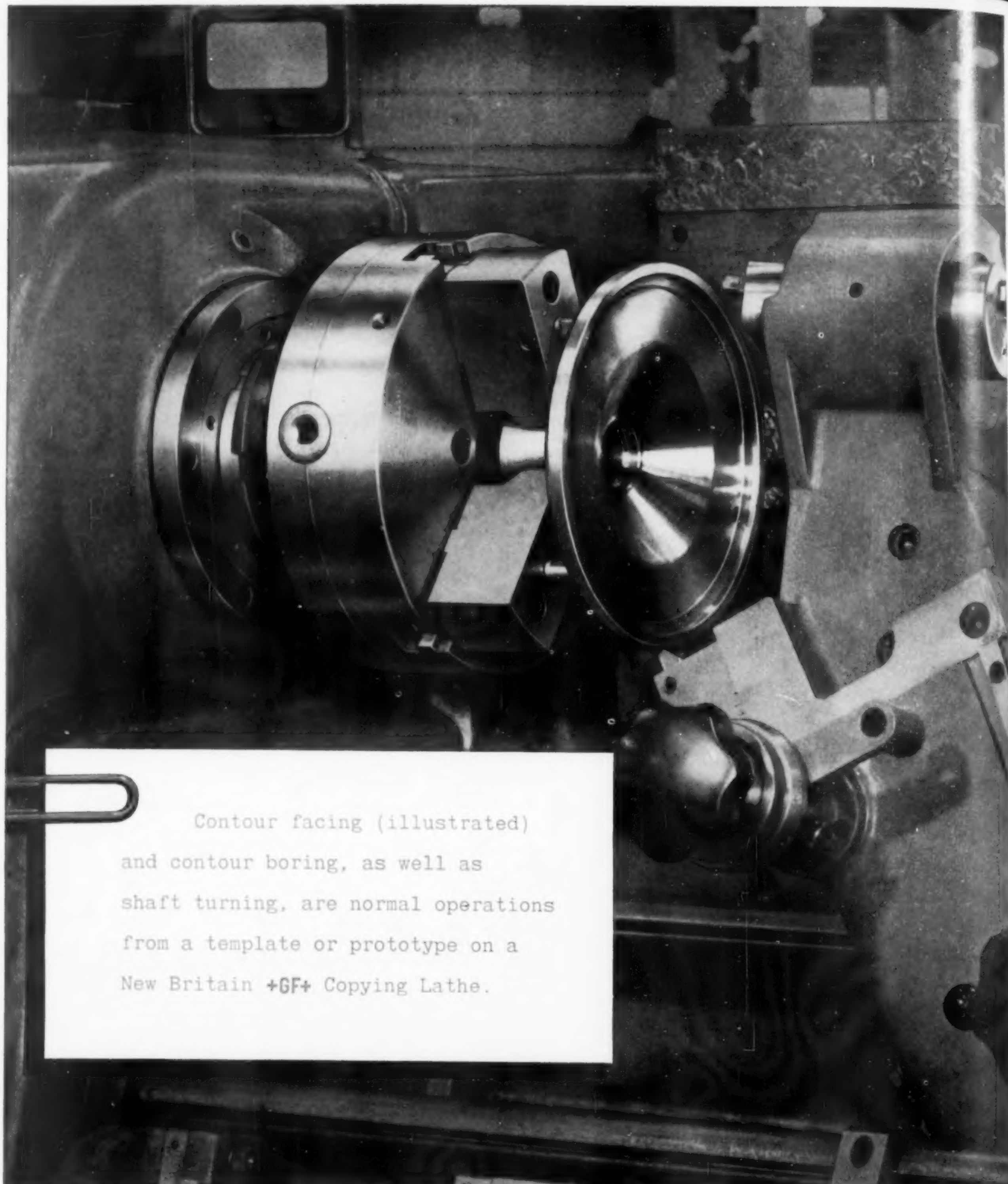

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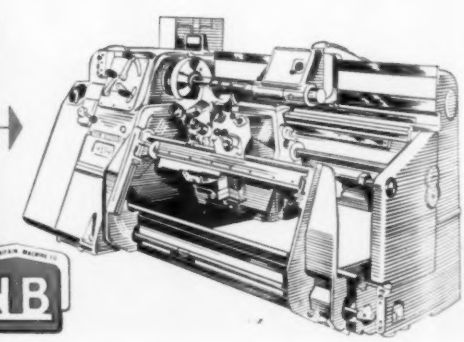

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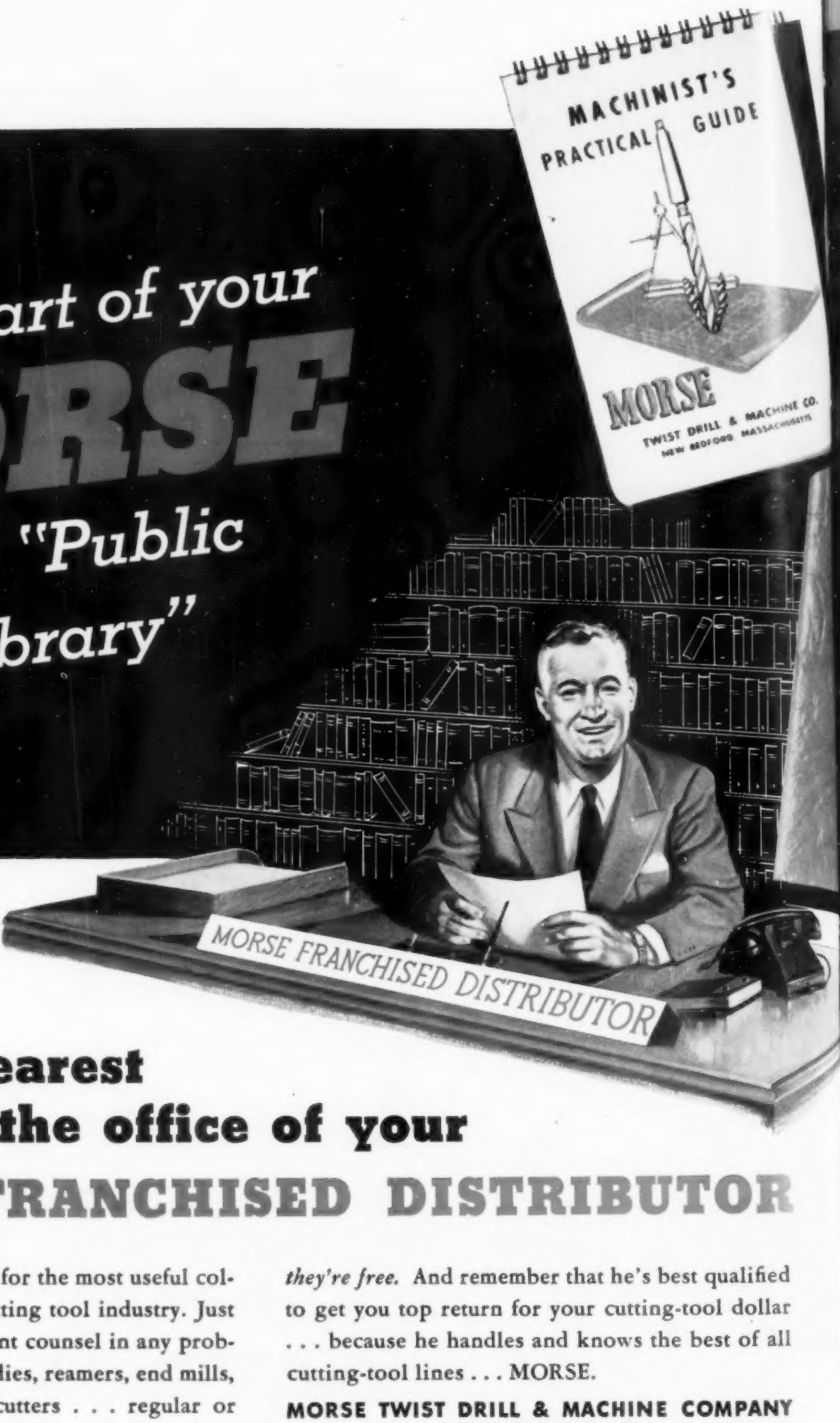

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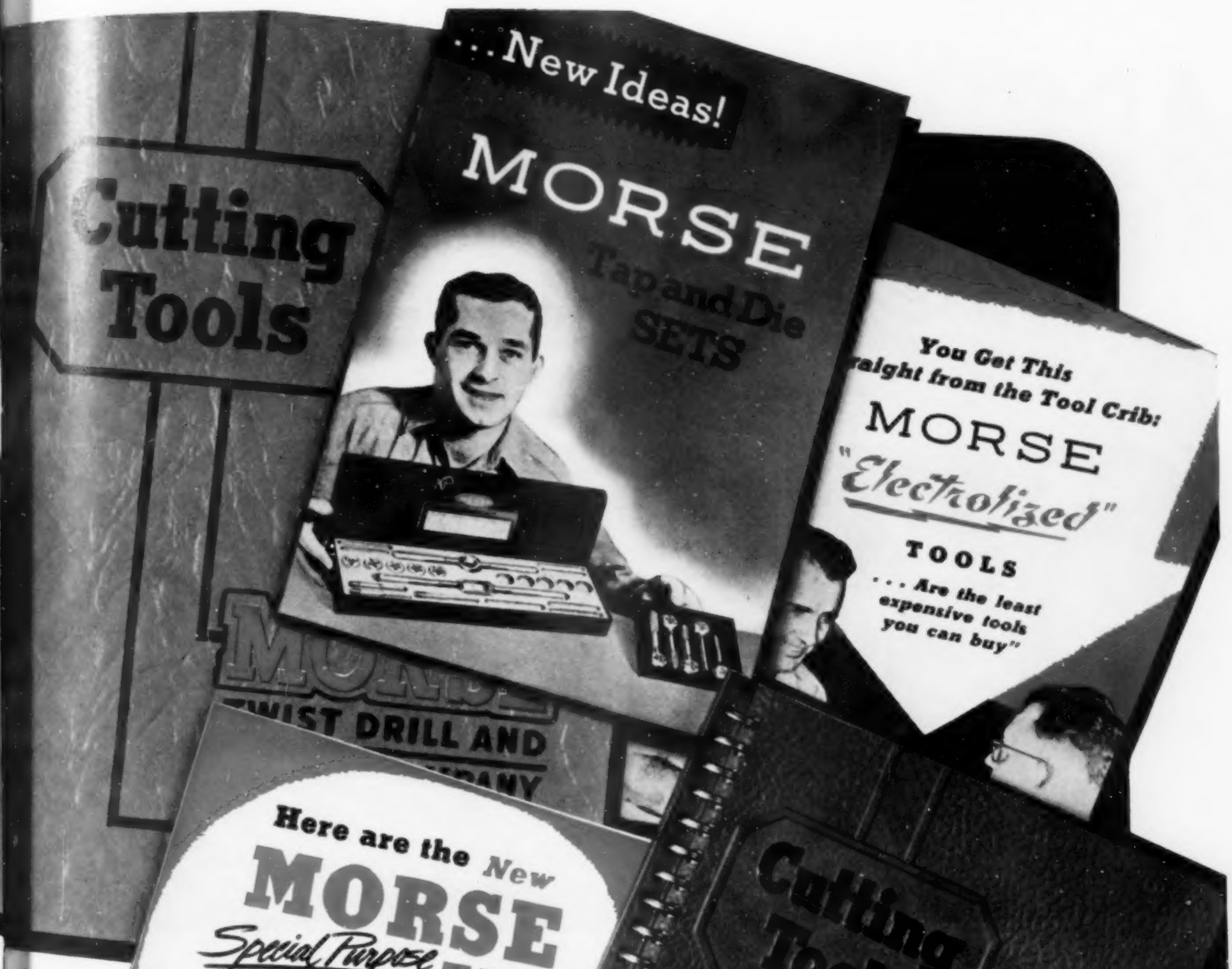

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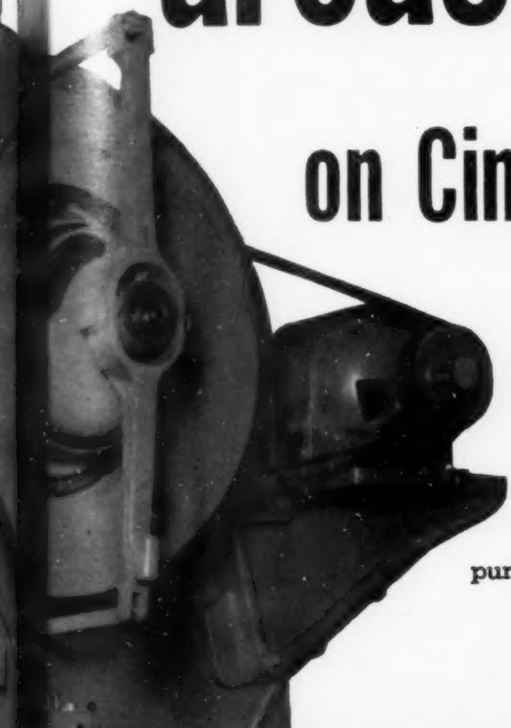

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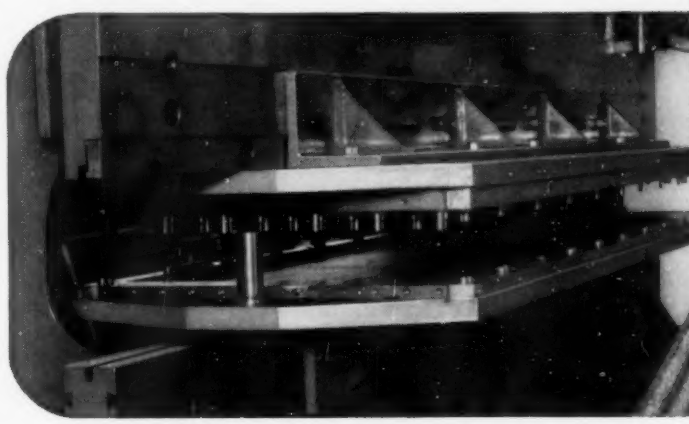

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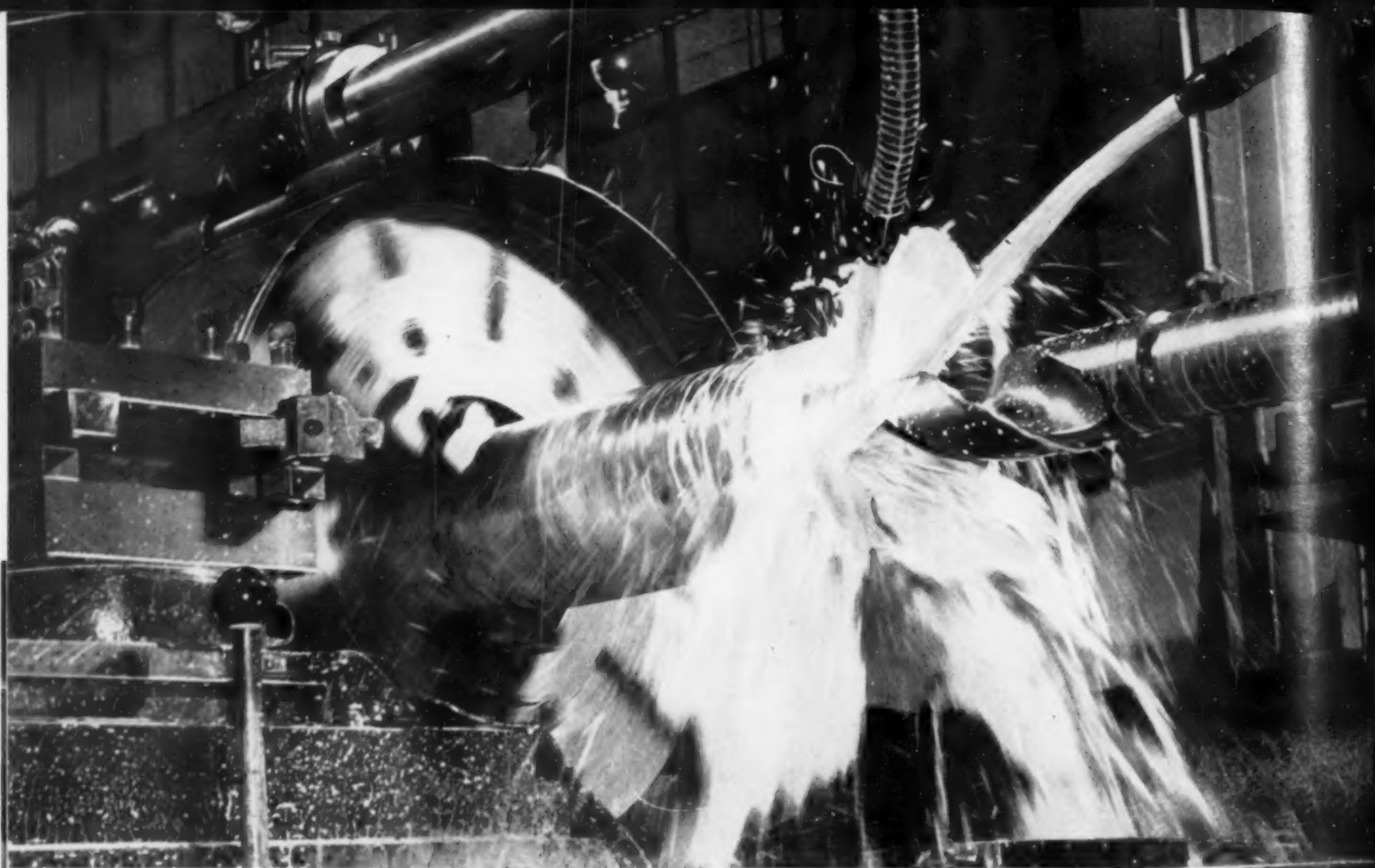

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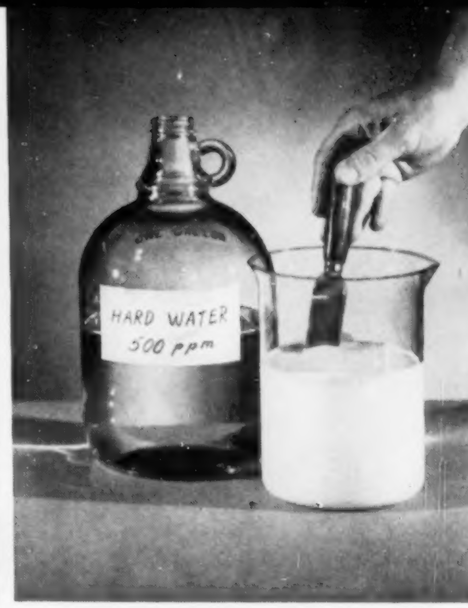

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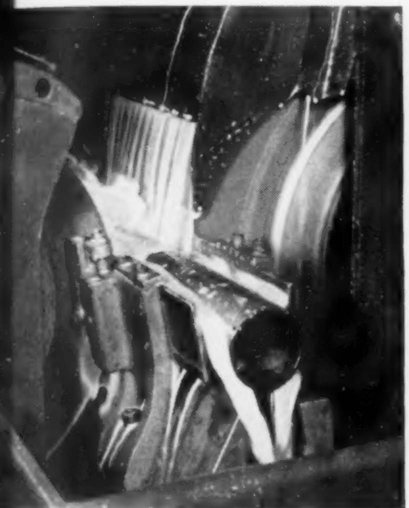

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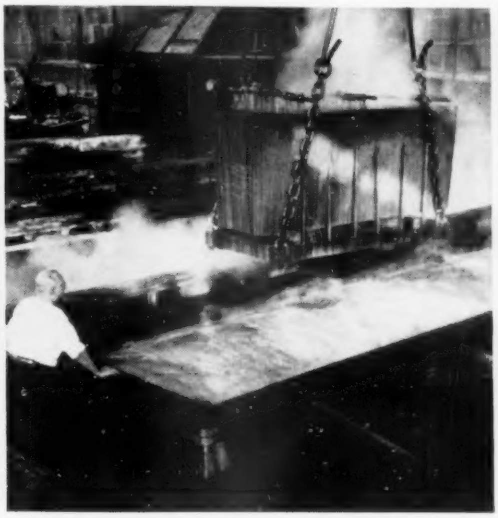

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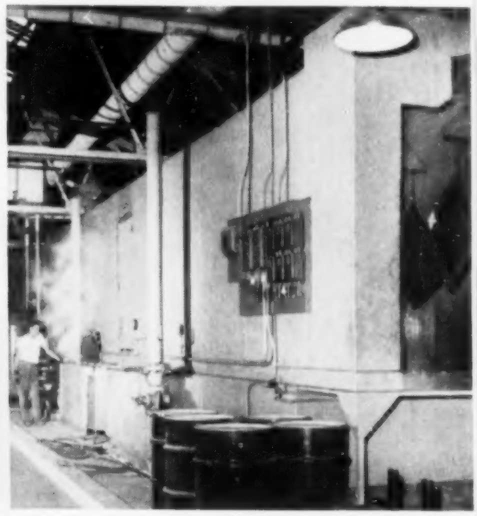

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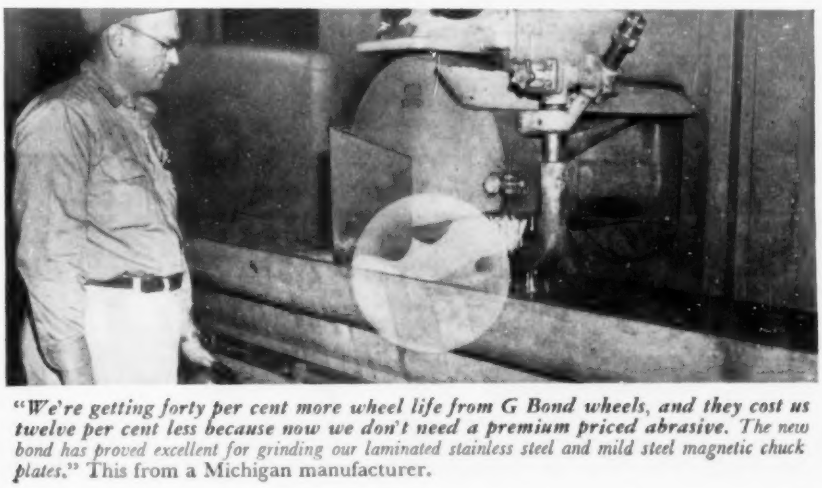

"We're getting forty per cent more wheel life from G Bond wheels, and they cost us twelve per cent less because now we don't need a premium priced abrasive. *The new bond has proved excellent for grinding our laminated stainless steel and mild steel magnetic chuck plates,"* This from a Michigan manufacturer.

The Tool Engineer

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It is particularly important that each member vote at his Chapter meeting in February to assure election of the best officers and national convention delegate. The continued health of the chapters and of the Society stems from these elections. In this Society, each member has not only the right to be represented by his delegate but also the responsibility of expressing himself regarding any changes in the basic policies and concepts of the Society.

Recently mailed to each member, a constitutionally processed ballot submits ten proposed amendments to the Constitution. They involve qualifications for senior, affiliate and associate memberships; field of operation of the Research Fund; enlarged membership for the Board of Directors; requirements for amending the By-Laws and the Constitution; requirements for presidency; election of president resulting from vacancy of office; and provisions for protecting the nonprofit character of the Society.

Each proposed change should be examined critically with respect to the effects it will have on the future of the Society in protecting and serving the profession. The only danger to a democratic organization lies in the failure of the members to intelligently exercise their voting privilege. It is the right of every member to have his day in court and to be heard. If he does not cast his ballot, he will have no one to blame but himself. Be sure to vote.

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PREVENTING PRESS FAILURES

Protecting Die Sets

By A. F. Gagne, Jr.*

Consulting Engineer
Binghamton, N. Y.

Prevention of die damage for the free-flowing output of flawless parts requires the constant attention of tool engineers, diemakers, and maintenance men. This article aids that endeavour by discussing numerous causes of die break down and prevenative measures.

POWER PRESSES, *Fig.* 1, are only economical when operation is not interrupted. Smashed dies can result in extensive damage in addition to interrupting operation. Direct die repair costs involve overhead expenses for inactive equipment, idle labor, interrupted schedules, and work delay in other departments. This article discusses varied causes of die damage and offers methods for avoiding them. The philosophy of approach and typical examples are presented that can aid in the solution of many situations. It is logical to discuss the design of jam-free dies first.

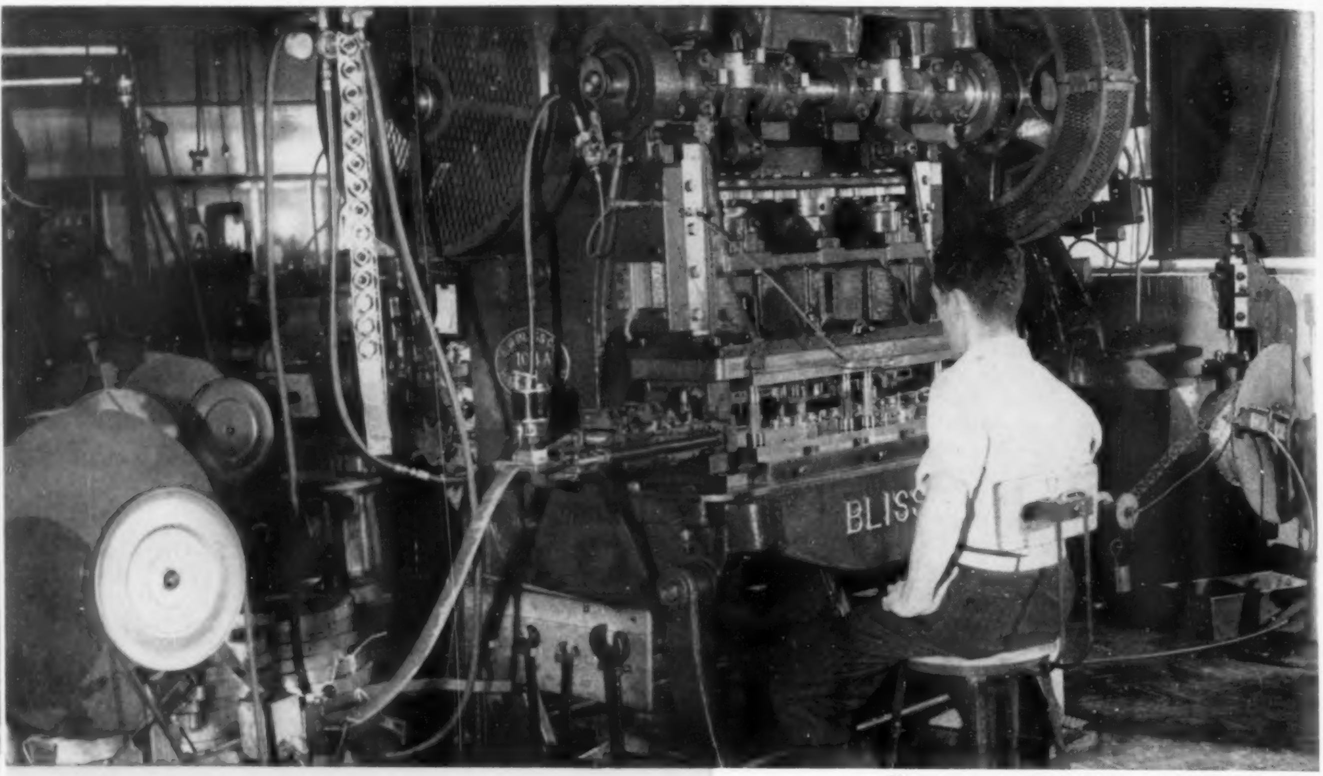
Punch and Die Cutting Clearance: Without proper clearance, punches and dies are particularly vulnerable to breakage. Upon entering stock, piercing punches form a straight-sided pocket displacing metal that bulges into the die opening and crowds out on all sides. Proceeding through, the punch and die generate localized tensile stresses in the stock, which ultimately cracks, spreading cone-shaped fractures. Correct clearance causes fractures to meet and a burrless slug pops out.

Insufficient cutting clearances result in primary fractures, leaving a connecting ring of metal that must be sheared by additional punch movement. Such clearance results in ragged edges, possibly doubled punch loads and, in the extreme, causes tiny cracks around the hole edge. Also, power consumption will be excessive, and if clearance is small enough to cause rubbing of punch and die on one side, tool life will be reduced.

Punch loads diminish with excessive clearances, but, since metal tends to drag, burrs are formed on the slug top and hole bottom while large radii are formed on the slug bottom and hole top. With soft metals, extreme clearances cause torn edges or a drawn shell. It is better to have too much clearance than too little unless hole straightness is important or if burrs cannot be economically removed, *Fig.* 2. Maximum clearance is almost a necessity when piercing stock equal in thickness to the hole diameter. Increasing cutting clearance and reducing accuracy requirements can lessen initial tooling costs and extend tool life.

Although commercial clearances usually range

*Senior member ASTE Binghampton Chapter



—Photo courtesy of John Volkert Metal Stamping, Inc.

Fig. 1. Dies and presses such as these represent a sizeable investment, well worth safeguarding against smashups.

between 3 and 10 percent of stock thickness, experiments with mild steel show reduction in punching and stripping loads when 25-percent clearance is used. Harder materials tend to fracture cleanly with at least 10-percent clearance while spring steels and aluminum, regardless of alloy or temper, require 12 to 15-percent.

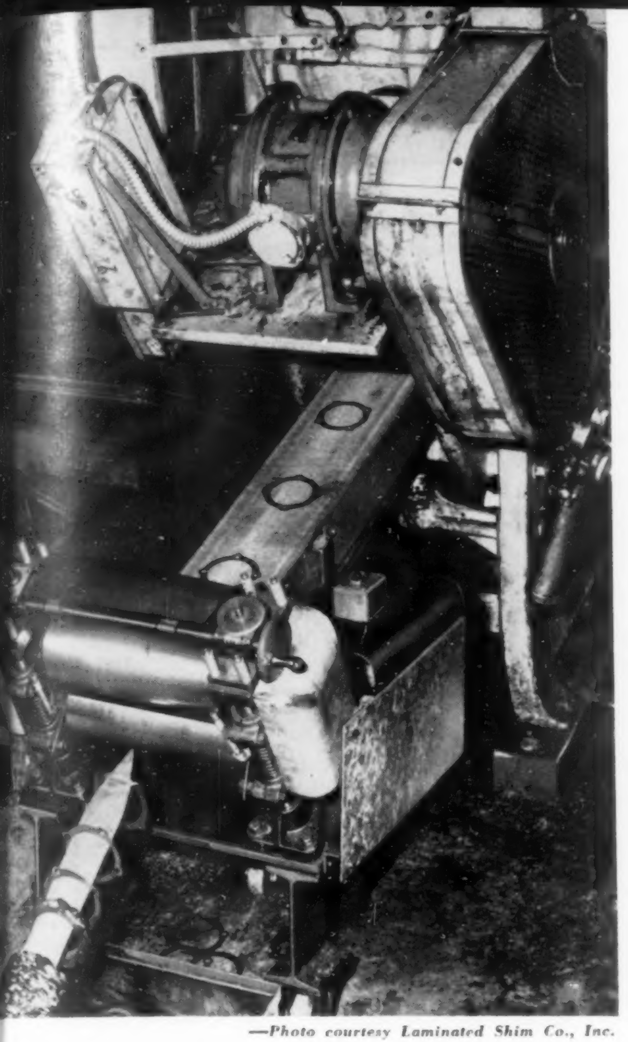
Draw Dies: Because draw operations are chiefly sensitive to clearance variations when ironing, insufficient clearance or inadequate punch and die radii may tear out the bottom and crack the upper corner of the shell, damaging punches and increasing press tonnage requirements. As clearances increase beyond one stock thickness, the ironing effect is lost and short shells result. Clearances over two stock thicknesses may cause wrinkling and poor quality.

To reduce number of draws and intermediate anneals, there is a tendency to exceed safe deep-draw percentage reductions, thereby increasing chances for punch-outs and torn edges. A margin of safety should be allowed for such normal operational irregularities as improper annealing, dirty stock, poor stock surface resulting from excessive grain size or imperfect pickling, and improperly made tools. Savings anticipated from reduced processing and handling are frequently lost by jams and smashups.

Tool Alignment: Since draw tools are rounded, accidental grazing contact of punch and die is not likely to cause damage. Alignment of blanking tools must be exact and can be checked by measuring the height of the brightly burnished band around the lower edge of the slug or blank. Variations in the height of this band warn of tool misalignment. Punch plate thickness should be at least one and one-half times the punch shank diameter to assure punch support. Metal-to-metal or light press fits should be used. Use of collets avoids the inaccuracies of setscrew locks and slip-fits insures easy removal of punches and tends to aid centering.

Slender piercing punches are deflected and broken by various conditions such as flaws in the stock, holes too close together, incomplete blanks, holes less than stock thickness from the edge, irregularly shaped holes and holes pierced at an angle.

A ground conical projection, *Fig.* 3, or chisel point on the punch tends to minimize punch slipping and shifting, and by bulging the stock into the die, also prevents stock from shifting. Non-



—Photo courtesy Laminated Shim Co., Inc.

Fig. 2. Deburring rolls for stamped shims are vernier-set to 0.001-in. increments of thickness.

symmetrical punches with proper shear can sometimes compensate for side thrust. Quill punches, *Fig.* 4, are another antideflection device. Made in two pieces, they are easily replaced and conserve space where hole clusters are necessary.

Tight fitting stripper plates, *Fig.* 5, are designed to avoid punch deflection. Such plates are applicable when the punch diameter is less than two stock thicknesses or when angle punching. Stationary type strippers give rigid support but moving strippers bear on the stock, providing guidance directly at the point of punch contact, especially benefiting wire size punches.

Stripper plate rigidity is important for tool alignment. Bending of the plate under stripping loads can throw punches out of line. To prevent this, strippers should be at least equal in thickness to the punch shoe plate.

One concern seeking causes of small punch failures, found that severe punch vibrations are set up at the moment of impact, causing breakage.* Resulting stresses, it was noted, are concentrated at any sudden change of punch diameter, eventually causing the punch to fatigue at this point. Equally severe stresses and vibration may also exist at the moments of break through and stripping.

A patented vibration damper (Whipsleeve) prolongs punch life and allows piercing of stock 50-percent thicker than the hole diameter. The damper, *Fig.* 6, which also guides the punch in the stripper, consists of a sleeve die cast over the punch end.

Die-Set Alignment: Standard die-sets provide heavy die shoes and guide posts and close-fitting post bushings to help assure constant punch and die alignment, minimizing the influence of worn presses and careless die setting and permitting quick setup and operating flexibility. Precision of 0.0001 inch clearance between bushings and posts, and shoe parallelism within 0.002 inch per foot is commercially available.

Grit and erratic lubrication may wear bushings, causing guidepost freezing, loss of alignment and tool rubbing. Oiling devices, *Fig.* 7, act to supply oil to remove dirt from guideposts. Flexible boots and telescoping covers can be used to protect grease-lubricated posts from dust, dirt and shattered punch pieces. Other means of minimizing precision die-set wear include bronze guidepost bushings; posts with built-in lubrication reservoirs; and chrome plated, nitrided or ball-bearing antifriction guideposts.

Extended die bosses, *Fig.* 8, are effective aids for critical alignment and shoes improperly supported by the press ram. Bosses can be specified on long stroke operations to prevent posts from clearing

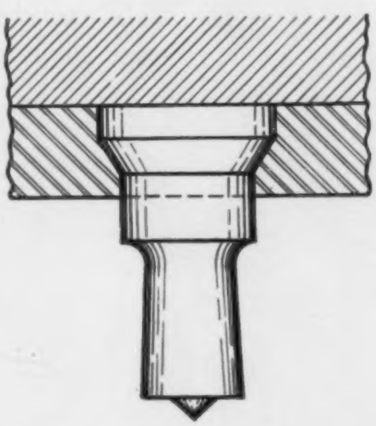
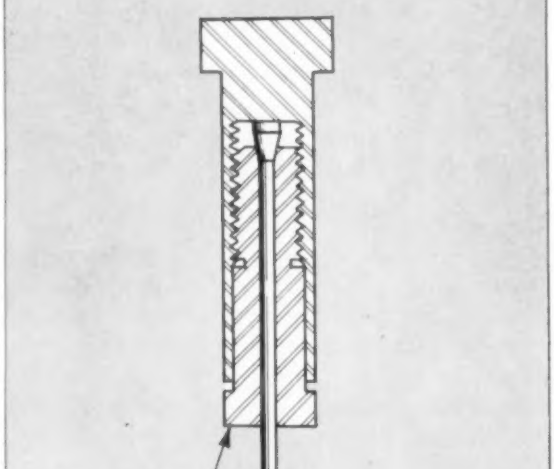


Fig. 3. Antislip cone tip reduces punch deflection.

*"Getting Longer Life from Punches," by O. W. Winter, THE TOOL ENGINEER, September, 1950.



—*Drawing courtesy Tool Craft Co.*

Fig. 4. Quick-change quill punches are quite rig[id] and are easily detached for sharpening or renewa[l]

bushings at the up stroke of the press.

To maintain die set rigidity and accuracy, the following steps have been found helpful:

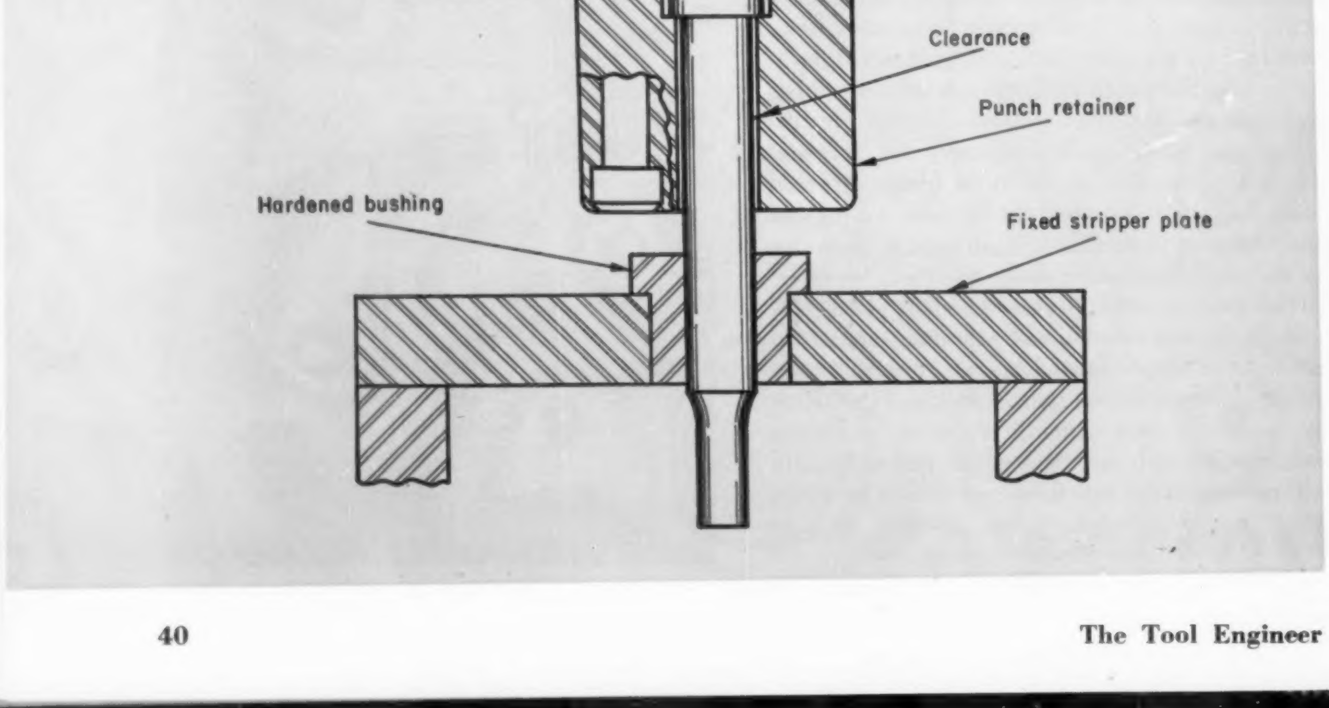
1. For full guidepost support, die shoe thickness should be at least $1\frac{1}{2}$ times the guidepost diameter. As an alternative, heavy welded or demountable bosses can be provided.
2. Guideposts should be heavy enough to resist deflection, i.e., 3-inch posts for precision sets where 2-inch posts would normally be acceptable. Shortening unsupported lengths of guideposts gives equivalen[t] results.
3. Provide more than two guideposts for increased support and accuracy.
4. Lay out die sets so the center of pressure falls on the ram center line.

Die Layout: Shearing tends to push surrounding metal back from the cut. If two piercing punches are close together, or if a cutoff punch is near a piercing punch, the side flow from the punches is obstructed, deflecting the lighter punch and shortening its life. Such difficulties can be lessened by using stripper guidance or by staggering punches vertically. Another solution is the separation of punches by distributing them through successive stations. Although this method may add an extra station, cost is usually not increased because die inserts and reinforcements are eliminated.

Crowding and jamming are apt to occur if a punch is located less than one or two stock thicknesses from a solid stop or gage. Heavy punches wear stops rapidly and sometimes force them out of position. Conversely, stops force light punches out of line. Spring loaded stops provide sufficient force for stock positioning yet yield under the stock swell produced by shearing.

Stripper Design for Blanking: Minimum stripper thickness for blanking can be determined

Fig. 5. Clearance in punch retainer permits close-fitting stripper bushing for accurate guiding of punch.



ather quickly from the following formula:**

$$T = 1/8\ (w/f + 16t)$$

where:

T = Thickness of stripper, inches
t = Thickness of stock, inches
w = Width of stock, inches

An additional allowance of 50-percent should be made for overhung or heavily counterbored strippers.

Stripper springs should have at least a 100-percent margin of safety to compensate for roughened or scored punches, oversize stock and broken springs. Unequal loads due to punch clusters can be compensated for by grouping springs in relation to the load. Positive cam operated strippers overcome the dangers of cocking or binding peculiar to spring strippers.

Reduced stripper loads lessen the possibility of a punch fracturing during stripping of heavy stock. Axial grinding of the punch is beneficial because the minute ring grooves resulting from radial grinding act as keys and increase stripping loads. Proper lubrication and flash chrome plating also benefit stripping by reducing the friction grip of the stock on the punch. Another method of easing stripping friction applicable only to punches over $\frac{1}{4}$ inch in diameter with stock over $\frac{3}{16}$-inch thick is to grind a taper relief above the cutting tips of the punches. This relief interferes with stripper guiding of the punch but, fortunately, accurate guiding is seldom needed for heavy stock because of the large clearance required. A $\frac{1}{16}$-inch clearance should be allowed on all sides between punch and stripper to prevent binding and ease tolerances when punches are heavy enough not to need guiding.

Strippers for Draw-Through Operations: An arrangement for stripping round cups under 1-inch diameter, *Fig.* 9, consists of two or more arc segments held together by a ring spring. When closed, the inside diameter of the segments is equal to the punch diameter. After the punch drives the finished cup through the stripper, the stripper closes above the top of the shell. On the return punch stroke, the stripper hooks shell from punch.

**H. Effgen, *Tool and Die Journal*, Sept. 1948.

—Photo courtesy Pivot Punch and Die Co.

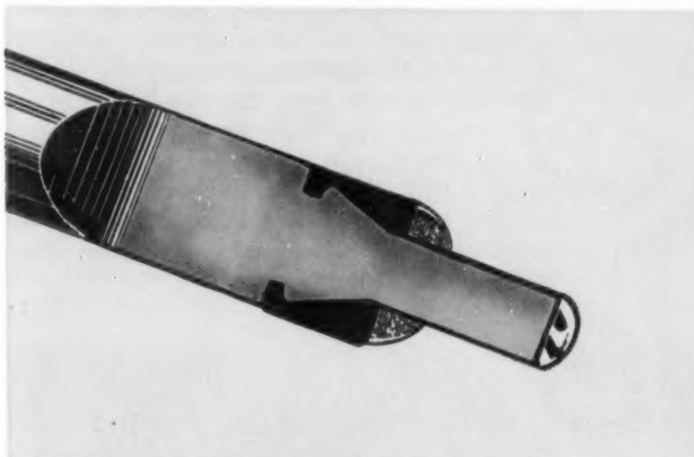
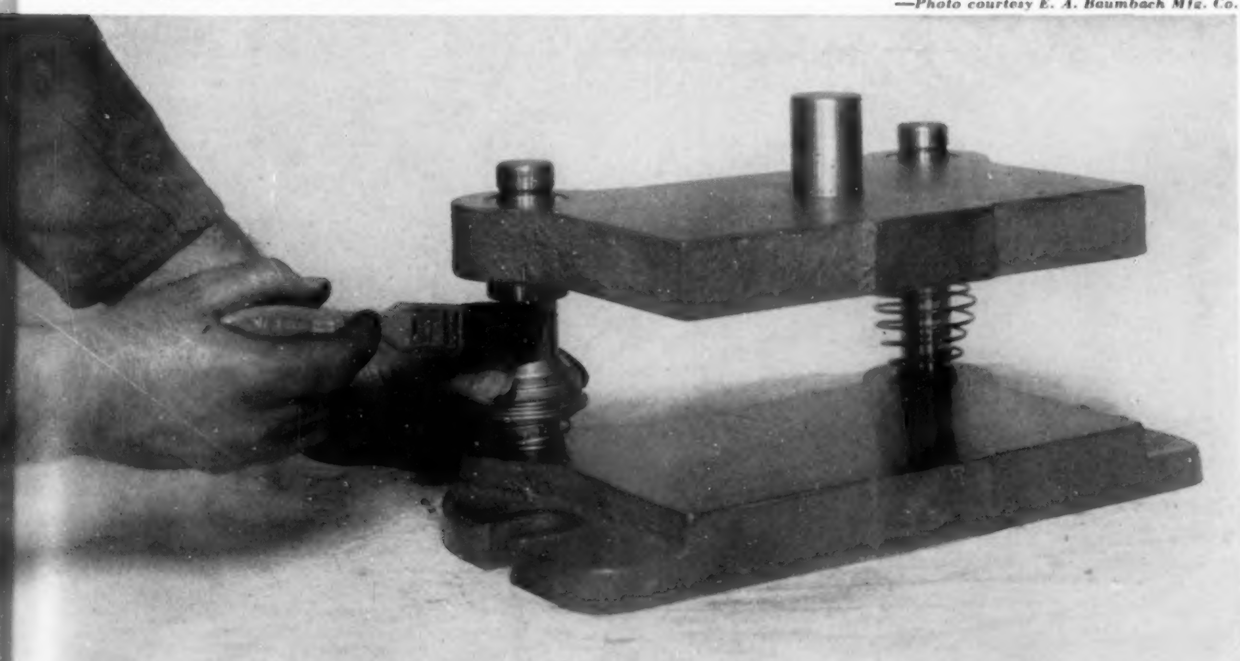


Fig. 6. (right) Whipsleeve punch prolongs life of slender punches by damping vibration and improving stripper guidance.

Fig. 7. (below) Guidepost oilers, replenished at regrinding help insure long tool life.

—Photo courtesy E. A. Baumbach Mfg. Co.



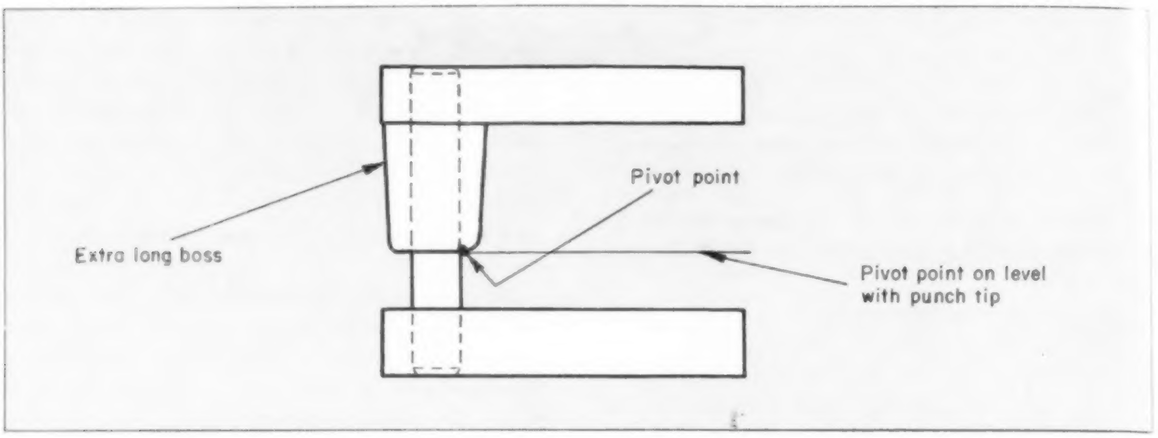


Fig. 8. Extra long bosses help to maintain parallelism of die shoes.

Blank Holders: Close control of pressure for draw-die blank holders is necessary to avoid fracture or wrinkle. It has been found that blank-holder pressure for deep draws should be maximum at the start of the draw, then taper off. Unfortunately, this is just the reverse of what can be obtained on a single-acting press with pressure pad loaded directly by a rubber pad or compression spring. Blank holders that can be automatically adjusted to give different pressures around the periphery of irregular blanks, during the draw stroke, give a maximum of control, *Fig.* 10.

Slug Clearance: To avoid fouling the die and smashing the punch, free discharge of punched slugs from the die button must be assured and slug pop-up prevented. A substantial land, overlying a long taper expanding down to the bottom of the button, is effective. Taper angles are not standard, but an included angle of ¾ deg is recommended. The taper should be smooth, and free of roughness and ridges which could give slugs a toehold for bridging and jamming.

A die that has worn to a bell mouth shape often causes slugs to pop up resulting in feed and punch

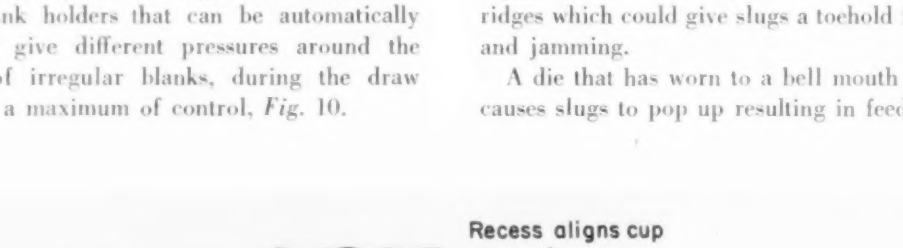


Fig. 9. Spring-loaded mechanical stripper for draw-through operation. Stripper relief prevents spring snagging and dirt build-up.

ns. Equally responsible is the diminished land e to resharpening. Both causes result in gradual crease of clearance which gives less gripping surce for slugs. A check should also be made for unch magnetism.

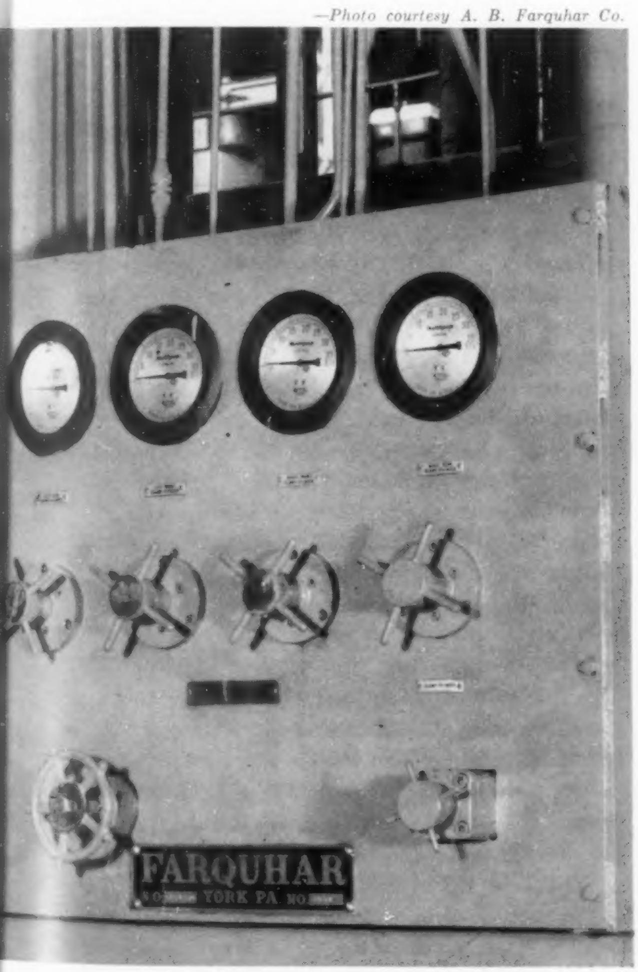
It is not enough to provide proper slug clearnce in the die button. Slugs must pass unobstructd through the shoe, bolster and bed. A chamfer, bevel or ledge might cause oily, sticky slugs to lodge and bridge. Side discharge holes, sometimes used on inclined presses, are risky unless an air blast or mechanical knockout is provided.

Tool Materials: Danger exists in specifying relatively high tool hardness to minimize wear. Gradual deterioration of punches or dies is safer and less costly than tool chippage or smashup.

Flash chrome plating of punches, or use of carbide die nibs and punch tips minimize wear and promote sustained high quality and long runs between grinds. Solid carbide piercing punches, more brittle than steel but with higher rigidity, have proven beneficial in certain progressive operations. To attain the full potential of carbide dies, extreme precision is necessary, and shoes and toolholders should be heavy enough to stall the press without harm to the die in the event of a jam. Carbide die sections should project above the steel parts of the die to permit resharpening without disassembly or loading the wheel with steel.

Fig. 10. Control panel for an adjustable blank holder is mounted on the press. Holder is powered by four individual hydraulic cylinders, each of which can be separately adjusted.

—Photo courtesy A. B. Farquhar Co.



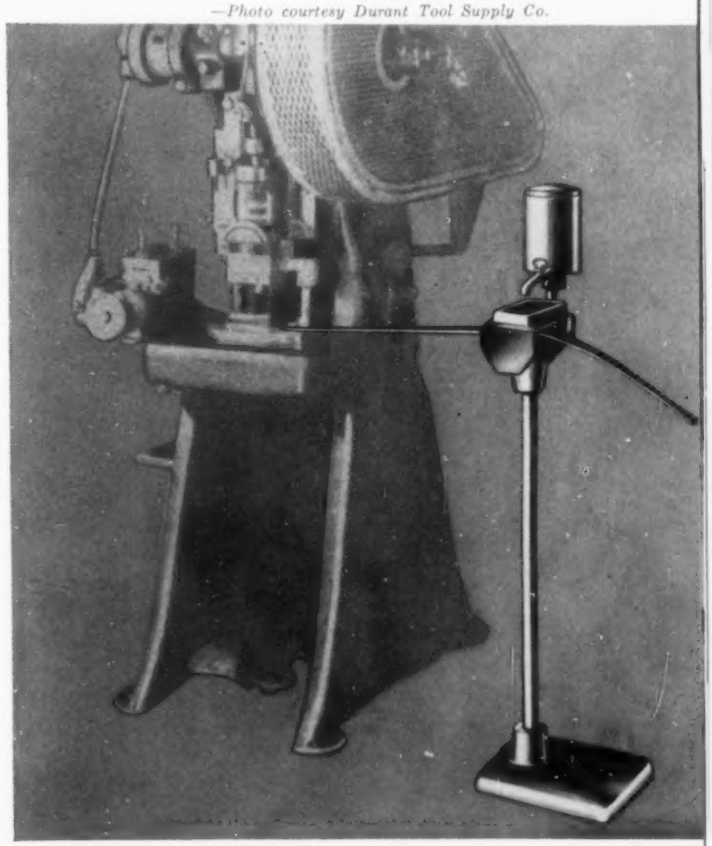
Tool Finish and Cutting Edge: Proper tool finish minimizes scoring of work and reduces the force required to form and draw. Galling and pick-up results unless a smoothly ground or lapped finish is provided on dies and punches. Grinding parallel to the punch axis also minimizes galling and pick-up tendencies.

As tool edges round with wear, blanking forces and burrs increase, and a point is reached where the tools begin to deteriorate rapidly. Blanking and piercing operations are improved with sharp 90-deg edges on the punch and die.

Too sharp a radius on draw dies may cause tearing and punch outs; similarly, too gradual a radius may cause wrinkling. Entrance tapers less than 20-deg included angle cause friction forces to increase and may result in punching through the shell bottom. Optimum die radius depends on the

Fig. 11. Stock oiler and cleaner lubricates and wipes stock in one operation.

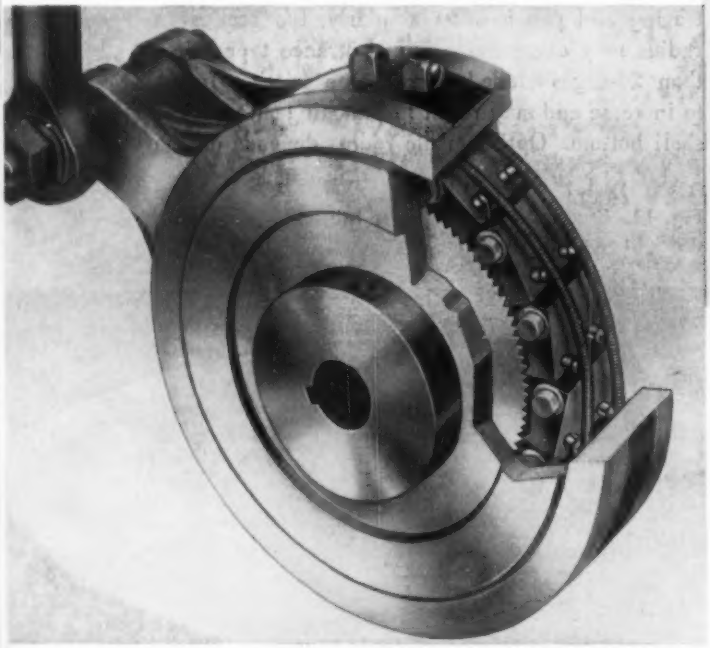
—Photo courtesy Durant Tool Supply Co.



—Photo courtesy Better Finishes and Coatings, Inc.

Fig. 12. (above) Peelable plastic coating 0.002 inch thick is sprayed on at steel mill to avoid scratches and to facilitate deep drawing. Film thins at corners during drawing, but does not rupture.

Fig. 13. (left) Multiple pawl ratchet feed is adjustable in 0.002-inch increments when using 2-inch rollers. Unit is enclosed, sealed and filled with oil.



—Photo courtesy Durant Tool Supply Co.

stock, lubrication and die material, but radii from four to eight stock thicknesses have been found to be good starting points. Where possible, tip radius should be four to six times stock thickness.

Stock Lubrication: Lubricants reduce rubbing and abrasion between tools and stock, increase tool life and improve part finish. Lubricated drawing operations increase draw depth, permit higher speeds by carrying away heat, and help avoid tears by reducing tonnage requirements.

More effective than brush or rag lubricant application is a method in which the stock passes through oiled, felt pads; cleaning and oiling in one operation, *Fig.* 11. Oil spraying of sheets, cups and other individual parts, and special coatings of wax or soap, baked on in previous wash and dry operations, give thorough coverage.

Because stock handling and feeding may be impaired by slippery lubricants, it has been found beneficial to use dry films such as dry-baked wax; copper, lead, or tin plates; phosphate coating; and strippable plastics, *Fig.* 12. Such additive coatings permit higher drawing speeds, deeper draws, fewer anneals and longer tool life. Some coatings prevent or minimize corrosion through the life of the product.

Feeding and Ejection: Long-run blanking operations with manual location of a strip against a stock gage sometimes results in a partial index, causing unbalanced forces that tend to throw the punch out of line, resulting in chipping of punch and die. Push feeding mechanisms, necessary on operations in which the scrap skeleton is severed in the last operation, are satisfactory on heavy stock but less practical on thin materials due to

ck buckling and jamming as the material passes rough the guides. Push-pull feeding overcomes is objection and avoids clutch or ratchet trouble feed roll drives. For best performance, the pper feed rolls should automatically rise during ch stroke, releasing and floating the stock to qualize any differences between push and pull feeds, and permitting accurate location by pilot pins. To prevent possible feed roll slippage, a motor-driven coil cradle or feed reel is often practical.

Roll feeds should be designed to allow the die to start a new roll without cutting half-blanks or jamming. Sheet feeds should be planned to prevent doubles in the die. Unless protected by an automatic stop, stock rolls can run out and the press operate empty. Without the deflection caused by working, especially when coining thin stock in an old press, the dies will come closer together and possibly hit with damaging results. A preventive measure is the installation of bumpers, such as vertical stop blocks welded in the die or heavy sleeves fitted over the guideposts.

Positive pawl-and-ratchet clutches for roll feeding devices have been found reliable but do not offer stock savings typical of friction clutches. Multiple pawl ratchet feeds, *Fig.* 13, compensate for this lack of economy. This device divides a circle into 6720 equal increments by providing 210 teeth on the hardened steel ratchet wheel which are engaged by any one of 32 pawls.

For reasons of economy, material for scrap skeletons may be less on progressive dies. Without allowance being made for substandard stock widths, skeletons may break and pile up to cause a smash. Wind-up reels sometimes whip or snap the scrap skeleton, breaking the web or pulling the strip out of line, causing a jam. Scrap choppers, *Fig.* 14, prevent this and avoid production halts for removal of scrap reels.

Danger of parts not being ejected before the downward stroke on open-back inclinable presses is completed, can be decreased by use of an air blast or positive knockout. Part sticking caused by lubricant adhesion can be avoided by using mechanical knockout or spring-loaded pins in the bottom of the punch. Punches too small for knockouts can be notched 0.010 inch to interrupt the lubricant film, thereby reducing adhesion. Steel blanking ejection troubles sometimes result from magnetized punches, dies or stock.

After feeding, there should be no pull or push by the feeding mechanism until after forming. Part and scrap should be removed without interfering with the incoming part or the die, and without damage to the part itself.

This is the first in a series of articles concerning prevention of power press smash-ups. Subsequent articles will discuss presses, trouble detectors, overload relief, and maintenance and operation of dies and presses.

Acknowledgments

Appreciation is extended to the following companies for supplying information for this article:

Acro Metal Stamping Co.	Milwaukee 12, Wisc.
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W. F. Meyers Co.	Bedford, Ind.
A. Schrader & Son	Brooklyn 17, N. Y.
Wiedemann Machine Co.	Philadelphia 32, Pa.

—Photo courtesy Durant Tool Supply Co.

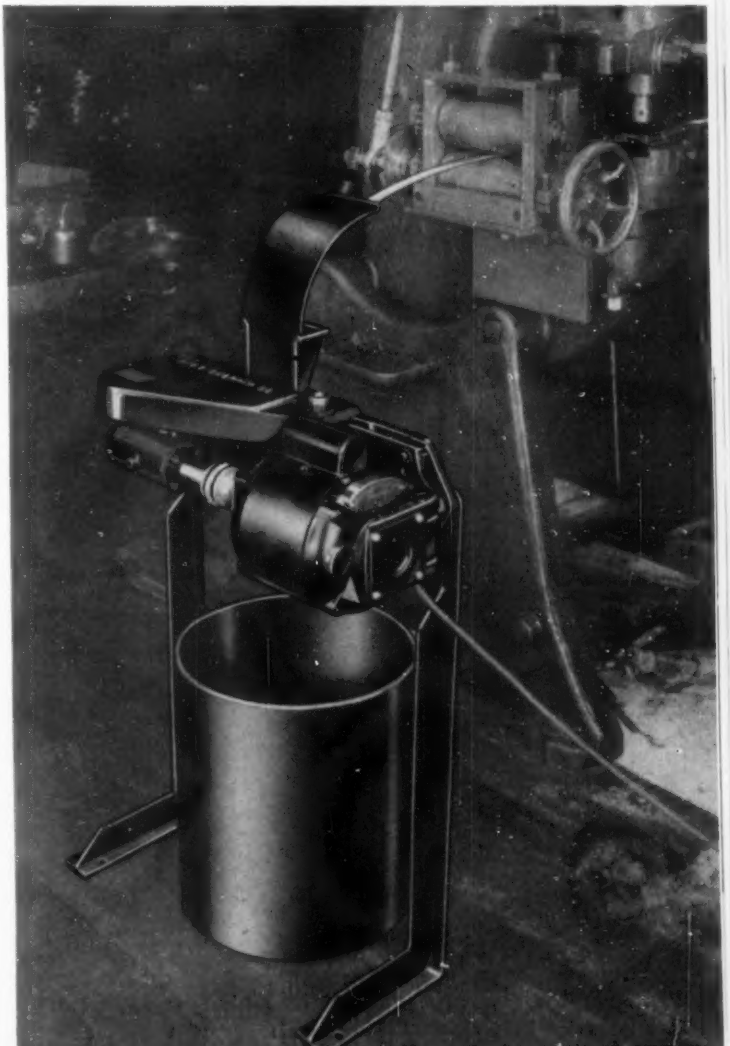


Fig. 14. Independently powered rather than ram-mounted, this scrap chopper does not interfere with use of pull roll feed. Loop of stock between cutter and rolls prevents cutter from tugging at roll when cutter becomes dull.

Gadgets

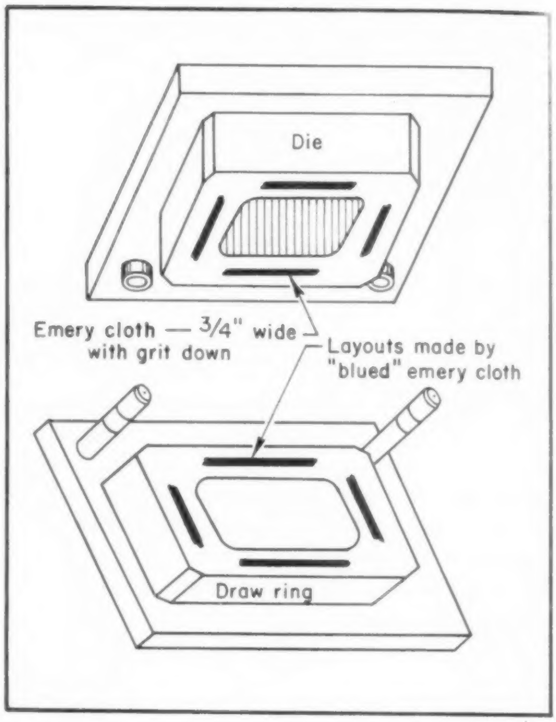
Ingenious Devices And Ideas To Help The Tool Engineer In His Daily Work

Draw Beads

Irregularly shaped deep-draw dies must be designed and constructed with draw beads to control the draw. The size, number and location of these beads cannot be determined accurately on the drawing board because of the variation of sheet metal thicknesses and physical properties of steel. Consequently, a trial-and-error method is adopted while incorporating draw beads. This necessitates excessive handling. Tryout of draw dies proves very costly especially where large tools are involved.

By placing a strip of emery cloth on the lower half of the draw die with the grit down, as shown, the proper length and location for the draw bead can be determined. Additional pieces determine the number required, i.e., double beads, triple beads, etc. This can be done without removing the die from the draw press.

During die tryout, when a satisfactory part is made, a layer of prussian blue is applied to the emery cloth, the draw ring is lowered to take the impression, thus marking the location of bead clearance grooves. The draw ring is elevated and a line scribed on the lower drawing surface around the emery cloth. The die is removed from the press and equipped with draw beads as indicated by the emery-cloth layout.



The only cost of this method is the price of the emery cloth, yet many toolroom hours can be eliminated, excessive die handling minimized, and more machine time made available for production of other stampings.

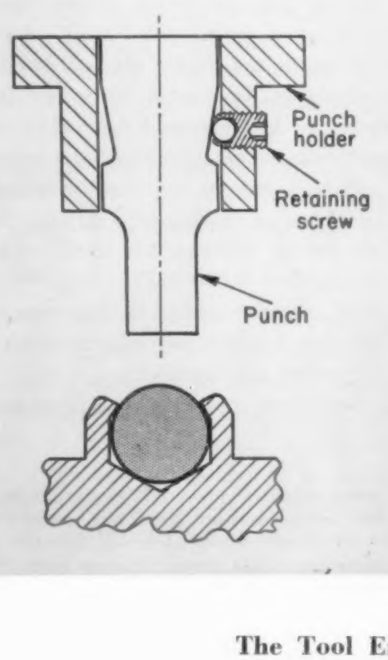
Nicholas Nikita
Windsor Chapter

Punch Retaining Screw

Standard dogpoint setscrews were originally used to retain punches in punch holders by rounding off the dogpoint. This was found unsatisfactory because the setscrew tip was much too soft. Hardening the screw failed to secure any improvement as the screw failed upon the application of adequate pressures to hold the punch.

A satisfactory solution was found by drilling out the dogpoint setscrew to receive a steel ball that is retained by crimping the tips of the point. In this manner a hardened tip and soft screw are possible. It was found that the ball acts as a bearing and does not rotate with the screw. Scored shanks have been practically eliminated because of this feature.

Frank Delfino
Bethel, Conn.



Preventing Nesting of Stacked Parts

Small stampings and similar parts frequently cause trouble in hopper feeds by cohering. The problem is especially critical with the part shown in the accompanying sketch, because of a welding projection in the center. After the projections are stamped in the parts by a slugging die, the parts are stacked in a hopper for automatic feeding in subsequent operations. During the stacking procedure some of the parts become jammed together because the welding projection of one part partially enters and becomes imbedded in the indentation of another, as indicated.

The difficulty was simply solved by grinding a 0.003-inch flat on the projection punch as shown in the enlarged die section. Nesting of two parts is thus prevented as the round welding projection of one is unable to enter the indentation of the other because of the added flat.

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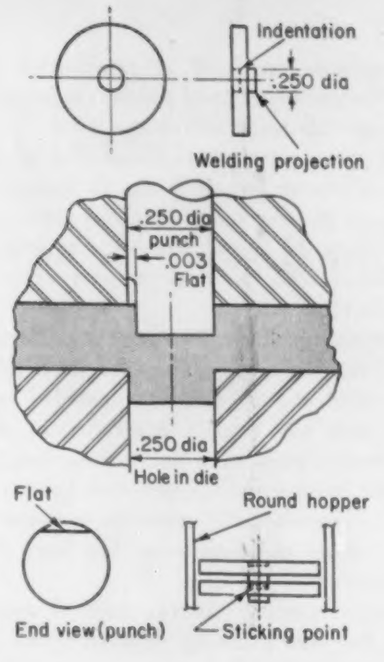
Dayton, Ohio

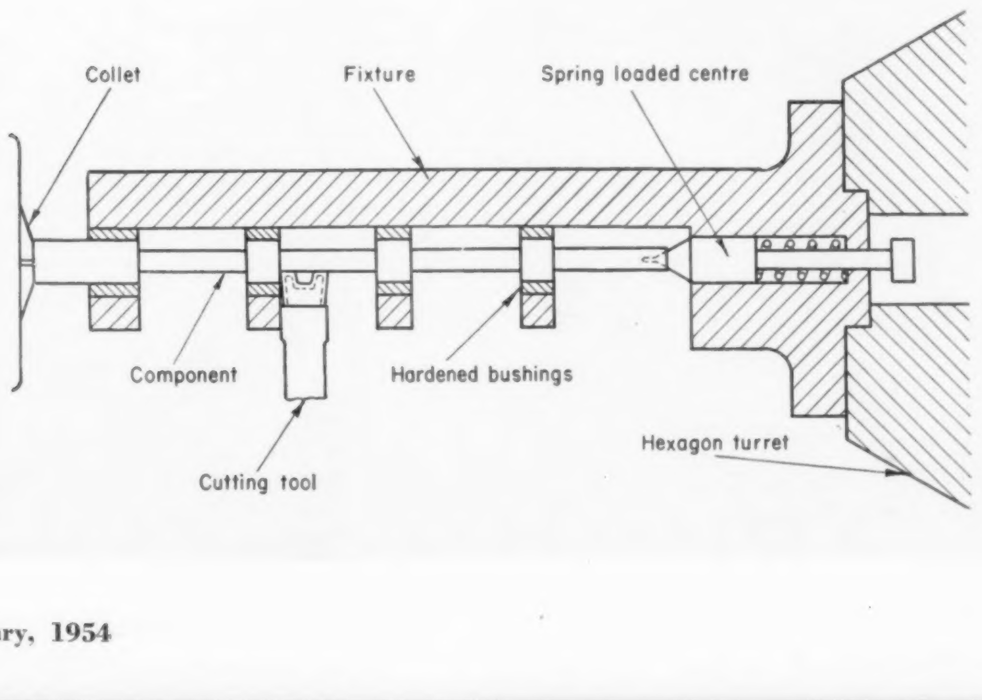


Machining and Grinding Fixtures

In machining pilot valves on turret lathes, due to the slender nature of the components, it proved difficult to rough them out of bar stock without distortion. Furthermore, the time required was unusually high because of the extremely light cuts necessitated. It was also difficult to control closely the various length dimensions to the tolerances of 0.005 to 0.010 inch. For this reason excessive grinding allowance was left on the faces. This, in turn, increased the time required for finish grinding and gave rise to difficulties in maintaining grinding wheel life and accuracy.

Solution to the problem was to stiffen the component during the turning operation by providing the support shown. This fixture consists of an iron casting mounted on one of the faces of the lathe hexagon turret, accurately bored to take four hardened bushings in which the bar stock blank could revolve for turning. The tail end of the component was center drilled for engagement with the hardened spring-loaded center incorporated in the turret end of the fixture.

The fixture is made to perform the further function of spacing accurately the various faces along the component length. Each bushing is made to the width of the machined control portion. These



preset surfaces are used in conjunction with a special V-shape cutting tool which is mounted on the front cross-slide tool post of the lathe.

Shape of the cutting tool allows it to be plunged into the revolving bar stock and to traverse longitudinally so that the small diameters can be turned together with the faces. The tool is arranged to make contact with the work support when facing the lengths required.

This arrangement has increased considerably the output of machined valves from the turret lathe and has permitted use of relatively unskilled labor to produce them with negligible scrap rate. Because of the close control over the various lengths obtained, the finish grinding operation has also been speeded up considerably since the material to be removed by the grinding wheel has been reduced to the minimum.

A similar spacing control method has been adopted for the grinding operation, as shown schematically in the illustration. A stop plate fixture with precision ground steps, indicating the required valve face positions, is secured to the top surface of the traversing table. Attached to the front of the machine fixed base is an adjustable stop member. The stop comprises a vertically positioned steel bar which is mounted on a hinge pin at its lower end so that it may be swivelled out of contact with the spacing plate on the machine table. This allows the stop to be fitted into another notch on the plate edge. The stop is retained in the upper position by means of spring-loaded ball catch engaging a dimple.

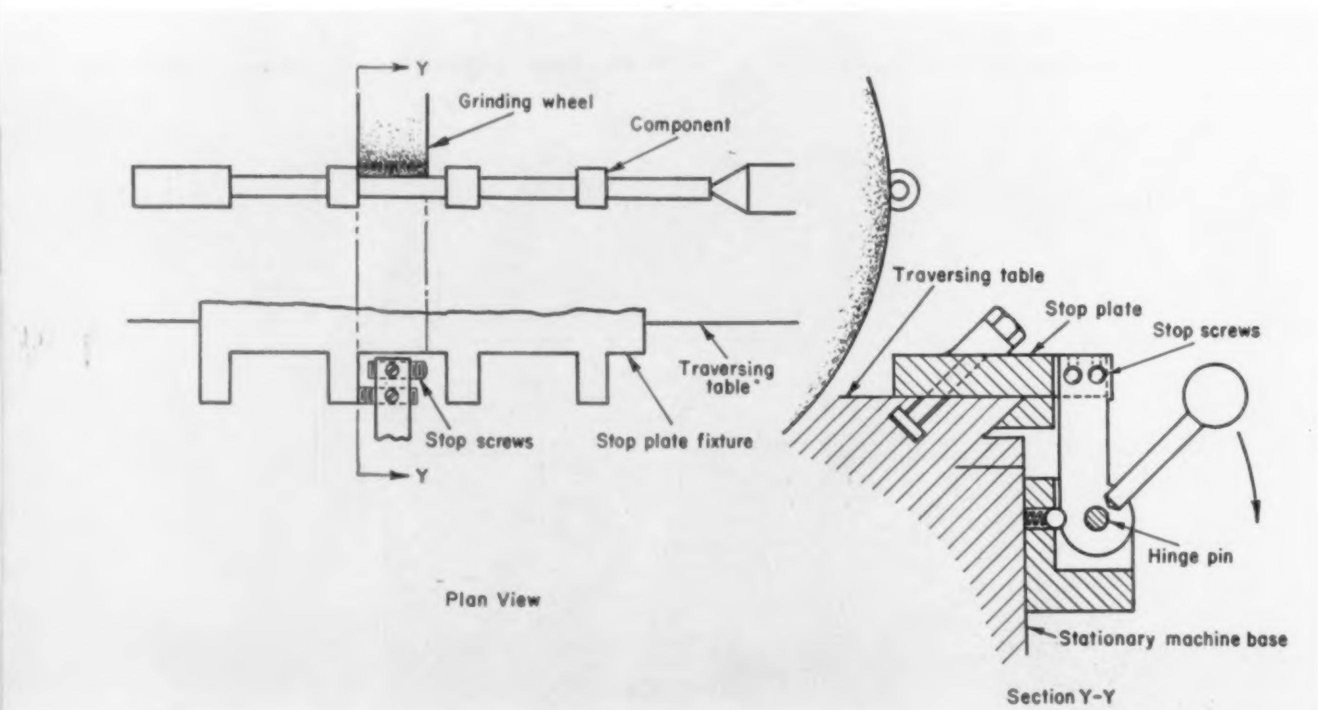
The adjustable stop actually consists of a pa of headless setscrews. From the plan view, it ca be seen that the distance between the ends of th adjusting screws corresponds to the grinding whe width. When this is refaced the stop must b reduced in width by a corresponding amount. Th is accomplished simply by measuring the ne wheel width with a micrometer and adjusting th stop screws so that their heads are a similar widt apart.

One of the wheel edges must be aligned with on of the stop screw heads. This is accomplished fairly simply by gaging one of the control diameter widths on the valve, grinding one face to gage and then setting one side of the screw stop so that it makes contact with the corresponding edge of the stop.

Position of the component in relation to the stop plate fixture is also important. The desired accuracy is achieved by controlling carefully the depth of the centers in the ends of the workpiece. Once the wheel has been dressed and the stop adjusted, it is possible to grind a large number of valves quickly to the required standard of accuracy, as the amount left for grinding on the faces is 0.003 inch.

Clifford T. Bower
London, England

Contributions for these pages describing short cuts for the tool engineer are welcome. Finished drawings are not necessary. Payment for accepted articles is made upon publication.



Practical Uses

of Statistical Quality Control

By Martin H. Saltz

Quality Control Engineer
Hughes Aircraft Co.
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This is the first of several articles on practical application of statistical quality control to production operations. To meet the requirements of a new Air Force contract at Arma Corp., the author designed and installed a program of statistical quality control. One of the major problems was to win the cooperation and support of shop supervision.

This presentation of workable statistical tools evolved from that and similar experience. It is the author's belief that results obtained are what count, despite any minor violations of statistical theory.

Having earned an MS degree in Industrial Engineering from Stevens Institute of Technology, he is familiar with theory as well as practice. He is the author of several articles on Statistical Analysis and has lectured at a national meeting of quality control engineers.

WHILE IT IS GENERALLY ACKNOWLEDGED that the solution to many production problems can be found with the help of statistical methods, often there is considerable resistance to the introduction of statistical quality control due to misunderstanding and lack of information. Other difficulties in applying statistical methods often result from the necessity of compromising strict statistical theory to secure a practical solution that is simple and reliable enough to work in the shop and at the same time enlist the cooperation of production personnel.

A program of quality control can be installed to secure the desired practical results with only a limited number of techniques borrowed from the statistician. Likewise these statistical tools can be made understandable to inspectors, and machine operators as well as to shop foremen, technicians and small shop owners and shop managers.

A successful system of this type was installed, for example, at the Arma Corp., to meet a new situation developing from undertaking defense contracts. As a particular problem developed, the appropriate statistical tool to meet that problem was installed by distributing the proposed procedure to members of supervision in the area. In this way, shop personnel needed only to become familiar with the particular phases of the program that affected

With this approach the field for application of quality control can be greatly broadened. Industry is already making widespread use of statistical methods in production. Some of the more profitable

Fig. 1. Typical of the uses of quality control is this application of average and range chart to a machining operation in the manufacture of gear blanks. The chart makes possible singling out variation trends for early correction.

December, 1952

RECEIVING AND SOURCE INSPECTION

SINGLE SAMPLING TABLE

Lot Size (N)	AQL = 0.65% Sample Size (n)	Ac (c)	Re	AQL =-1.0% Sample Size (n)	Ac (c)	Re	AQL =-1.5% Sample Size (n)	Ac (c)	Re	AQL = 4.0% Sample Size (n)	Ac (c)	Re
2 to 8	All	0	1	All	0	1	All	0	1	*5	0	1
9 to 15	All	0	1	All	0	1	*10	0	1	5	0	1
16 to 25	All	0	1	15	0	1	10	0	1	5	0	1
26 to 40	25	0	1	15	0	1	10	0	1	5	0	1
41 to 65	25	0	1	15	0	1	10	0	1	15	1	2
66 to 110	25	0	1	15	0	1	10	0	1	15	1	2
111 to 180	25	0	1	15	0	1	35	1	2	25	2	3
181 to 300	25	0	1	50	1	2	35	1	2	35	3	4
301 to 500	75	1	2	50	1	2	50	2	3	50	4	5
501 to 800	75	1	2	75	2	3	75	3	4	75	6	7
801 to 1,300	110	2	3	110	3	4	110	4	5	110	8	9
1,301 to 3,200	150	3	4	150	4	5	150	5	6	150	11	12
3,201 to 8,000	225	4	5	225	5	6	225	8	9	225	17	18
8,001 to 22,000	300	5	6	300	7	8	300	10	11	300	20	21
22,001 to 110,000	450	7	8	450	10	11	450	14	15	450	29	30

Table based on
MIL-STD-105A
Inspection Level II
Table IV

*When sample size exceeds the lot size do 100% inspection

Fig. 2. Typical sampling table for use in receiving department, adapted from MIL-STD-105-A. Many firms find it more practical to adapt tables such as this, from military standards than produce their own.

and proved techniques include the following:

Detection of Factors Causing Rejection: Before adoption of statistical quality control, much of this type of work was merely trouble-shooting. The approach was haphazard and unscientific. Considerable time was spent chasing down factors that proved to be negligible, while certain more important factors were never uncovered.

Proper Distribution of Inspection Time: Statistical quality control concentrates inspection effort where necessary and indicates when inspection can be loosened. Instead of determining the amount of inspection needed at a particular phase of an operation by a hit-or-miss technique, statistical quality control provides a method of determining proper distribution of inspection time.

Early Determination of Quality Trends: It is important in any manufacturing operation to determine as soon as possible, and as accurately, the quality level to be maintained. This applies even to the receiving department where normally little is known concerning quality of purchased parts. Where quality is known, no use is made of the information. Statistical quality control provides a technique for adjusting an inspection program to take into account the accumulated data. Also, difficulty in the assembly areas, traceable to poor quality in other departments, is brought to light by the proper application of these techniques. Similarly, trends in fabrication, machining and even shipping operations, are vividly demonstrated.

An Aid in Economic Design: At present, the asignment of tolerances, types of finish and other design features are made with little thought of difficulties of producing desired results economically. Frequently much difficulty occurs in production in maintaining a particular design feature that is relatively minor and which could be easily eliminated from the specifications. Usually, tolerances are assigned on a tight-as-possible basis in order to make certain that assemblies will function properly. This practice is an example of a technically wasteful method that can be corrected with the proper application of statistical techniques.

Determining Quality Level: As a subcontractor or vendor, manufacturers have difficulty with buyers for two main reasons. One is lack of information concerning the quality of product being shipped. The second is inability to produce a product of consistent quality. Statistical quality control can solve both problems. No manufacturer or producer turns out a perfect product; it would be impractical to attempt to do so.

Government Contracts: At present much precision work is being performed either directly or indirectly for the government. Many contracts contain stipulations insisting that acceptable statistical quality control techniques be applied in the operations. These requirements are described in MIL-Q-5923-B.

In practical operation, much of the work done by quality control engineers is repetitive and the number of statistical techniques used are relatively few. The theory on which they are based can be reduced to a few essentials which are readily understood. So, it is unnecessary for a production engineer to have a formal education in statistics in order to apply quality control tools in his work.

Listed here are a number of the statistical tools which have proven of value in numerous industrial applications.

Average and Range Control Charts: Commonly termed $\overline{X}$ & R, average and range control charts find two basic applications. One is for process control and the other is in the acceptance of production lots. Because of a wide variety of factors, no two parts are produced identical. When inspection of a process or operation is based on measurement of a dimension or other characteristic that varies in production, the $\overline{X}$ & R control chart is probably the most effective statistical tool available. An analysis of the samples taken from production is presented so as to form a picture of the variations in the process. It makes possible distinguishing between small, inherent causes for variation that are unimportant and relatively large factors that should be corrected. When possible to distinguish between inherent causes of variation and assignable causes, unnecessary adjustments, changing of machine settings and other wasted efforts can be eliminated. It is therefore possible to turn out a satisfactory product at a minimum cost. A typical $\overline{X}$ & R control chart is shown in *Fig. 1*.

Percent Defective Control Charts: In practice, much inspection is performed on an attribute basis, that is where the attribute (characteristic or dimension) being inspected is classified as good or bad. The $\overline{X}$ & R chart is unsuited for this type of inspection. In such instances, the percent defective control chart, known as the p chart is used. It can be applied without making any change in the method of recording inspection data. This is possible because the chart is based on the ratio of items rejected to items inspected. This is frequently the first statistical technique used in a plant because of the ease with which it can be installed and maintained. In such applications, it serves as a

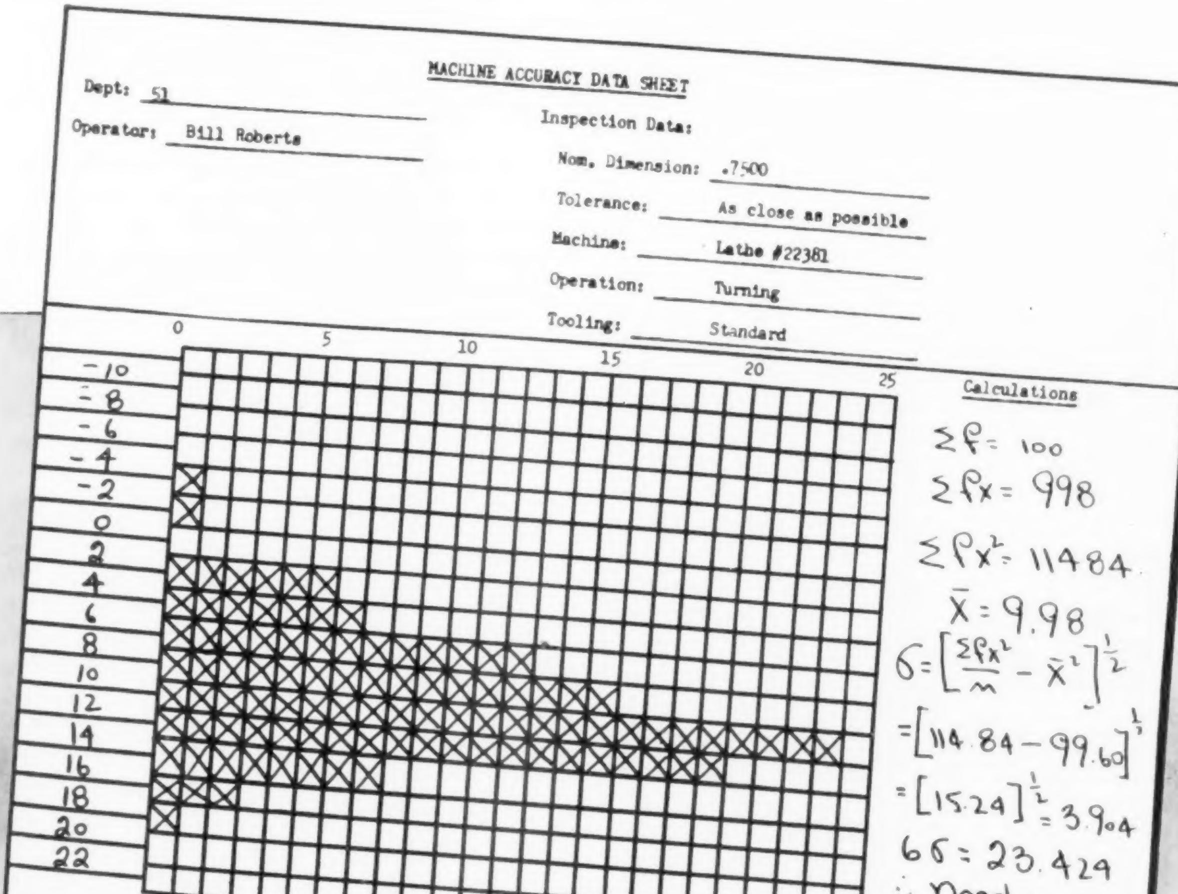

Fig. 3. Typical form used in conducting a machine capability study. This data sheet illustrates the method of recording data and computations.

detector of trouble spots that require more comprehensive installations such as $\bar{X}$ & R charts.

Defects per Unit Control Charts: Neither $\bar{X}$ & R charts nor p charts apply to production of plated material, wired electric circuits and similar products. In these cases, many different types of defects are possible. When a dimension of a machined part is measured, it is either to specifications or not. A plated surface, however, may have one blemish or many. The defects per unit control chart or c chart finds its application here. For firms engaged in manufacture of complex electromechanical assemblies, this type of chart is finding wider popular appeal. An elaboration of it, currently becoming more popular with various government agencies, applies a demerit rating system to complex assemblies for rating product quality.

Attribute Sampling Plans: It is generally conceded that 100 percent inspection of parts is less effective than might be assumed. This is due to fatigue, unavoidable human error and other factors generally uncontrollable. When inspection is performed by attributes, it is more advantageous to apply a sampling plan than inspect every part. Properly designed sampling plans permit acceptance of lots of parts or material based on inspection of a relatively small sample. This involves certain risks. It has the advantage, however, over 100-percent inspection in that the risks are known and can be controlled by adjusting the sampling.

A typical plan, indicating lot size, size of sample and number of allowable rejects is shown in *Fig.* 2. This plan consists of accepting a lot on the basis of inspection of samples. With this method, 95 percent of the time lots of the desired quality level (AQL) will be accepted and 5 percent of the time acceptable lots will be rejected. Such sampling plans are widely used by the U. S. Army and Navy. They fall into several categories referred to in MIL-STD-105-A, as single sampling plans, double sampling plans and multiple sampling plans. The names indicate whether the lot in question is accepted or rejected from inspection of a single sample, two samples or more. By properly choosing a sampling plan, the amount of inspection can be balanced against the risk of accepting a defective part, depending on the importance of the part, value etc.

Variable Sampling Plans: Certain tests and inspections are destructive, expensive and time consuming. These are: salt water tests, shear tests, life tests and other breakdown types. When using these, it is desirable to destroy as few parts as possible to arrive at a picture of the quality of the product. For this, sampling plans are used, based on inspection by varieties. Administration of such a plan is more difficult than inspection by attributes, yet by proper organization it is possible to test a smaller sample and get a more accurate quality picture.

In Line Inspection of Attributes: Usually inspection is performed for acceptance purposes after the run of parts is completed. This results in tying up parts awaiting inspection. To avoid this delay, sampling plans can be designed so that inspection can be performed while the work is in progress and completed at the finish of the run.

Machine Capability Studies: In the past, many shops have assigned jobs to machines without prior knowledge of the capability of the equipment to hold required tolerance. Often, jobs have been set up with tooling and machines incapable of attaining the specified tolerances. The result is considerable scrap. Inspection of every part is required to segregate rejects. To overcome this problem some more progressive firms have installed machine capability studies. Such a program, *Fig.* 3, provides production planning with a picture of results that can be expected from a machine and tooling combination under optimum conditions. By comparing this value with drawing tolerances, it can be determined if the job can be handled on a production basis. If not, either the tooling or the machine is changed to improve the capability of the setup. Studies of this sort repeated periodically provide a picture of machine wear. That can serve as a guide for maintenance and rebuilding schedules.

When a study is repeated on a particular machine with two different sets of tooling, the more suitable one for close tolerance work can be determined. The one best suited to the situation is then used.

Determining Tolerances Statistically: The practice of assigning tight-as-possible tolerances to assure that parts of an assembly will be within specifications is costly. The closer the tolerance, the more expensive a part will be. Under this system, a satisfactory assembly is secured if the two worst parts are mated. If the two best parts are mated, an assembly much more accurate than required will be secured. As there is small probability that the two worst parts will be mated, it is unnecessary to assign tolerances on a tight-as-possible basis to secure assemblies within specifications. After analyzing the production statistically, tolerances can be assigned realistically at a considerable saving.

Result Evaluation and Experiment Design: Frequently, production must establish methods and tooling on a trial basis to furnish information for the completion of a design best suited to the manufacturing facilities. Experiments of this sort are frequently haphazard and data analysis is visual. This approach results, in many cases, in ambiguous conclusions. Experiments of this type should be designed so that data gives the information desired so conclusions will be valid and undistorted by apparent trends. To secure these results, the setup of the experiment, taking of the data and analysis should all be established on a statistical basis.

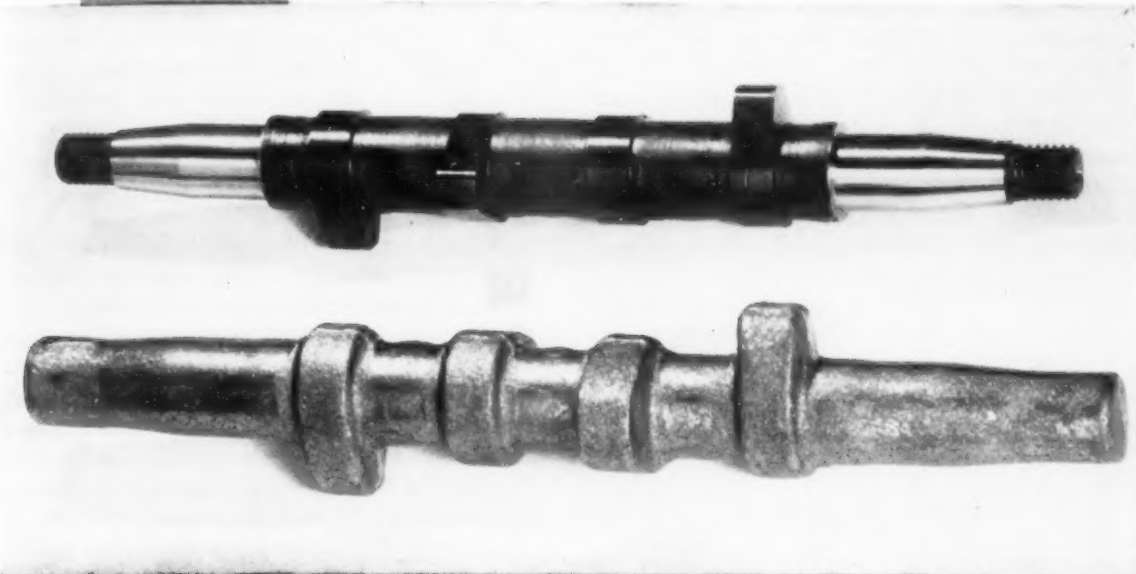

Fig. 1. The process for manufacturing this camshaft was improved through application of the index system of tolerance charts by the engineer in charge at the American Bosch Corp., Springfield, Mass.

Index Tolerance Chart

Simplifies Production

By Allen Johnson*

President
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RECENT CHANGES in production inspection and control have shown the need for a better, more uniform method of computing tolerance charts for use with manufacturing layouts. A well-constructed tolerance chart is indispensable to a good process layout. Such charts can be instrumental in avoiding costly production snarls and scrap. Taken together, process layouts and tolerance charts can bring to light such things as dimensions taken from poor locating points, tolerances that have been cut, and improper relation of castings and forgings to finished parts. The tolerance chart permits engineering changes when they cost the least, before the purchase of tools and gages.

The primary purpose of a tolerance chart is to reduce the cost of a manufactured article, *Fig.* 1. Since the chart is itself an added cost of this article, every effort should be made to minimize the cost of the chart. The following system of tolerance charting has been developed to maintain utmost simplicity.

Each surface that concerns a linear dimension is assigned a number in the index system of tolerance charting. Beginning with 1 at the left edge of the part and proceeding to the right each vertical surface is assigned a number. When two of these numbers are written in combination, such as 4-13, the dimension for the linear distance from surface 4 to surface 13 is automatically indexed. The first number of any dimension index indicates the locating surface and the second number indicates the surface being machined.

To avoid confusion, the component is represented as a chart line during early study of the basic rules of the index system. The chart line, *Fig.* 2, represents the linear axis of the component. Numbered dots placed on the chart line represent surfaces on the component. When these dots are given the

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same dimensions as are shown on the component drawing, a table of index values can be evolved, *Fig.* 2.

Proper arrangement of the index table is essential. The dimensions are set down from top to bottom in the order of their machining and the index numbers representing each dimension are placed next to them. The first number of each index combination must be the locating surface for that dimension.

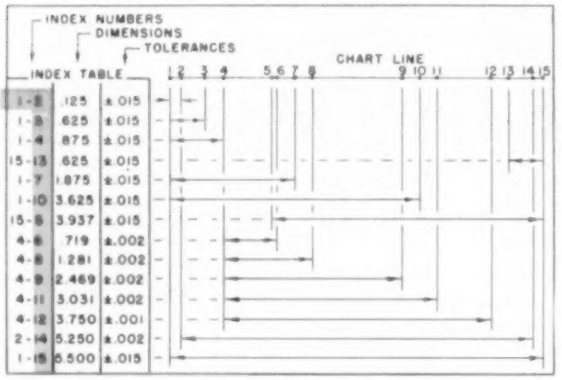


Fig. 2. An index table and chart line represent the starting point for preparing a tolerance chart by the index system. The colored line shows a method for checking that all values are used.

sion. This can be checked by drawing a line through the top dimension index and then downward through all the numbers in the second column. All the index numbers must appear on this line once but only once. If this is not so, a dimension has been repeated, omitted or assigned an incorrect locating point on the component drawing or the index table.

Distance Between Surfaces

During preparation of a process layout, it is often necessary to determine the distance between two surfaces where no dimension exists on the component drawing. The index table expedites solution of such problems. A typical case, the distance between surfaces 4 and 13, will be used to introduce the principles of the index system. Only basic dimensions are used; tolerance computations will be included later.

To make such calculations simple and to include only those component dimensions that apply, a step-by-step solution has been found best. The problem is solved by writing down the index numbers of the desired dimension and then working upward. The progressive growth of the method is shown in *Fig.* 3, with each step being shown in boldface type.

Since the answer is unknown, its index numbers are set down as shown in Step 1. The solution to the problem is obtained by finding either (a) the known quantities that add up to the desired dimension or (b) the known quantity of which the distance between surfaces 4 and 13 and some other known distance are complementary parts. In either case the known dimensions are included in the index table.

How It's Used

Beginning at the bottom of the right-hand column of index numbers a search upward is made until either of the dimension numbers desired is found. Of these two 13 is found first as part of the index number 15-13 representing a known dimension of 0.625 (any units can be used so long as they are consistent). This dimension index and its dimensional value are added to the problem as Step 2 in *Fig.* 3. The chart line, *Fig.* 2 shows that distances 4-13 and 15-13 lie adjacent to each other and are complementary parts of distance 4-15, for which a dimension must be found in order to obtain a solution.

A quick method for determining that 4-15 is the next distance to be determined is to cover the one common number above and below the line. The two remaining numbers represent an index, 4-15, for which a dimension must be found.

Again starting at the bottom of the right-hand column of index numbers a search is made for either a 4 or a 15. When 1-15 is found, it can be seen that this index does not represent the one for which a dimension is required and the data is not yet complete. The index 1-15 and its value of 5.500 is set down as Step 4. Covering the common number above and below the line, it is determined that distance 1-4 is required. A search up the index table locates index 1-4 with a known dimension of 0.875. This completes the data for the problem.

To determine if addition or subtraction should be done, the following test applies: if the common index number in the two combinations (in this case 1) falls within the dimension index in the answer to that particular section, the function is one of addition; if the common number falls outside the dimension index, subtraction is indicated with the smaller dimension as the subtrahend. Since 1 is outside the dimension indicated, by 4-15, subtraction is used. It makes no difference that the smaller dimension, 0.875, is on top.

Subtraction of 0.875 from 5.500 results in a dimension for the index 4-15. This makes Section B of Step 6 a complete problem. Since the common number, 15, falls outside the span of the desired index dimension, subtraction is indicated. Subtracting 0.625 from 4.625 gives a dimension of 4.000 for the desired index combination.

Whether known dimensions are added or subtracted, their tolerances must be added. Despite the tendency for tolerances to average out in actual manufacturing, quality control results prove that

y can and do reach the permitted extremes. anufacturing and inspection functions must both lculate all dimensional variations along both ex- emes which means that all tolerances must be lded.

To maintain the simplicity of the Index System, ll dimensions must have equal bilateral tolerances. his avoids the confusion that could result from dding or subtracting plus and minus tolerances. (For convenience in converting unilateral and un- qual bilateral to equal bilateral tolerances, a Toler- ance Conversion Table is published on Page 89 of this issue.) When tolerances are expressed in equal bilateral terms they are always plus-and-minus and introduce no confusion.

The final step of the illustrative problem, *Fig.* 3, would be as shown in *Fig.* 4 when tolerances are included. No tolerances are shown for those items that are incidental to the solution of the problem and which cannot be found in the index table. The tolerance of the final dimension is thus the summation of all the tolerances shown above it. This same method can be used if it is only necessary to find accumulated tolerances.

Before a tolerance chart can be devised, the manufacturing method or sequence of operations for producing the part must be established. As a typical component, the hypothetical camshaft of *Fig.* 5 will be considered for production by a hypothetical sequence of operations as shown.

The sequence of operations sketch is probably the most clarifying aid when making a tolerance chart. It serves as a permanent reference for checking the tolerance chart as the latter is developed, assuring that the chart will coincide with the chosen methods of manufacture. Indicating each surface on the sketch with its index number makes simple the identification of locating surfaces and machined surfaces in each operation. The sketch is also a visual aid in determining amounts of stock removal most suitable for each tool involved, plus a help in noting which surfaces, if any, are indirectly machined.

The item of stock removal occurs each time that a surface is machined more than once. For example, even though surface 1 is faced in Operation 20 and has no subsequent machining, that surface was first established during the forging stage. Surface 1 is machined a second time when it is faced for the purposes of a tolerance chart. The amount of stock removed during machining is determined by noting that surface 15 is the locating point for the facing of surface 1. The distance between those two points is found for the part condition just after and just prior to the operation in question and the smaller subtracted from the other (adding the tolerances).

The four main symbols appearing on the tolerance chart are shown in *Fig.* 6 with their definitions. Any other conditions of dimensioning that might arise can be explained in footnotes referred to by asterisks.

Stock Removal Tolerance

Sometimes dimensional variations accumulate to the extent that the tolerance on stock removal is greater than the basic stock removal itself, such as on dimension 11-15 in Operation 10, *Fig.* 7. This does not mean that the minimum stock removal is a minus quantity. It means that the high limit of

Fig. 3. (below) Step-by-step determination of the distance between surfaces 4 and 13 for which no dimension is given on the component drawing. Boldface numbers indicate what is done in each step.

Fig. 4. (right) The same problem calculated in *Fig.* 3, after tolerances have been taken into account. Tolerances are omitted for intermediate dimensions.

−1-4 =	.875	±.015
1-15 =	5.500	±.015
4-15 =	4.625	
−15-13 =	.625	±.015
4-13 =	4.000	±.045

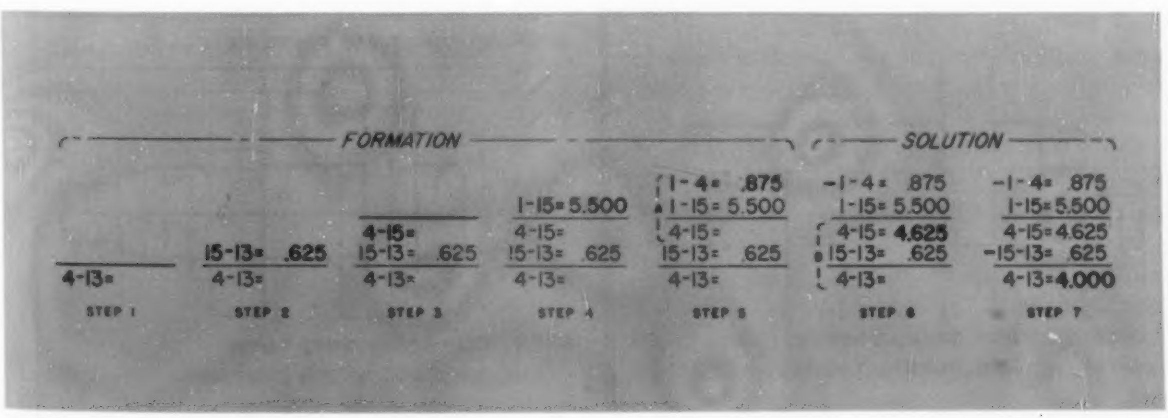
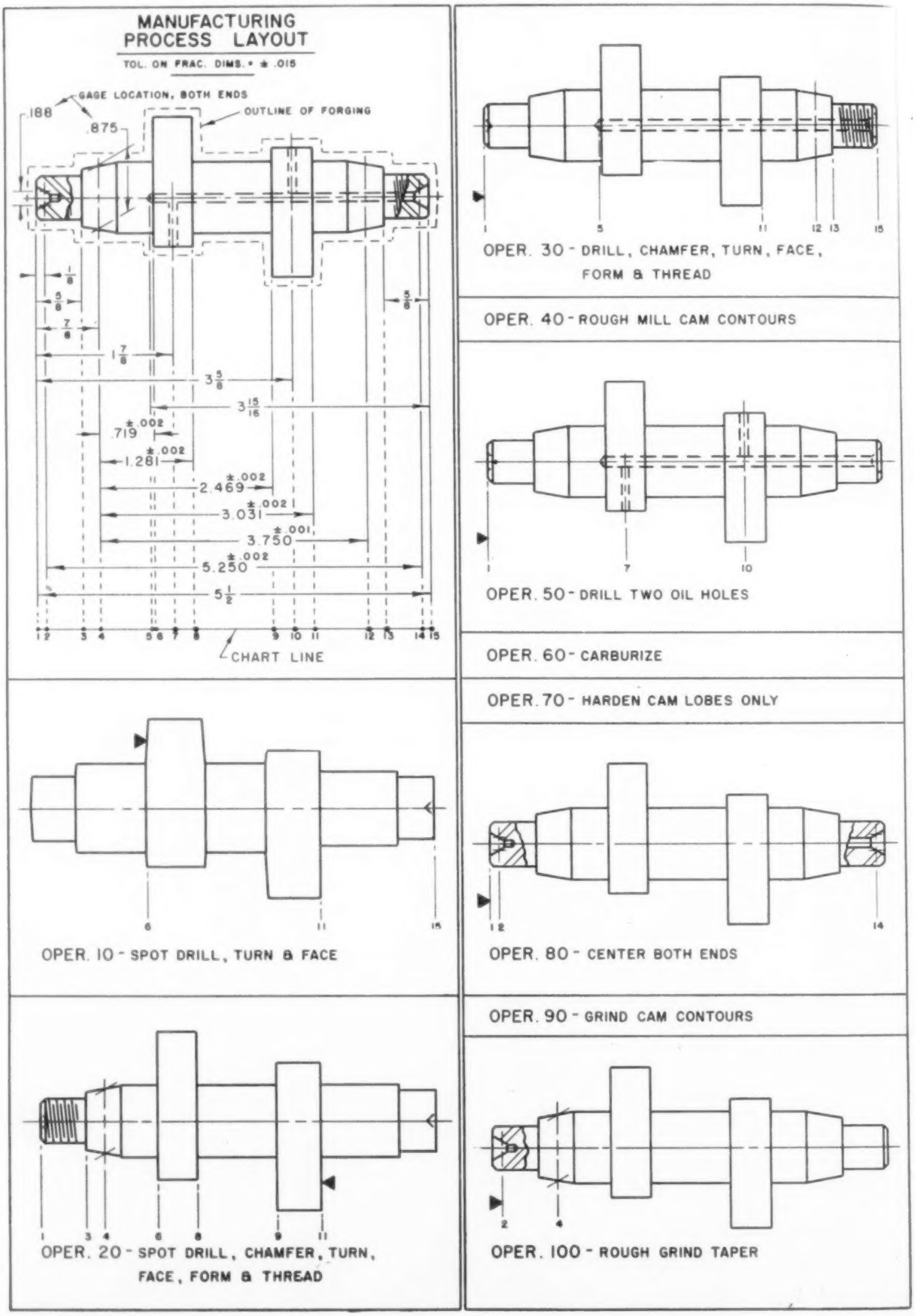
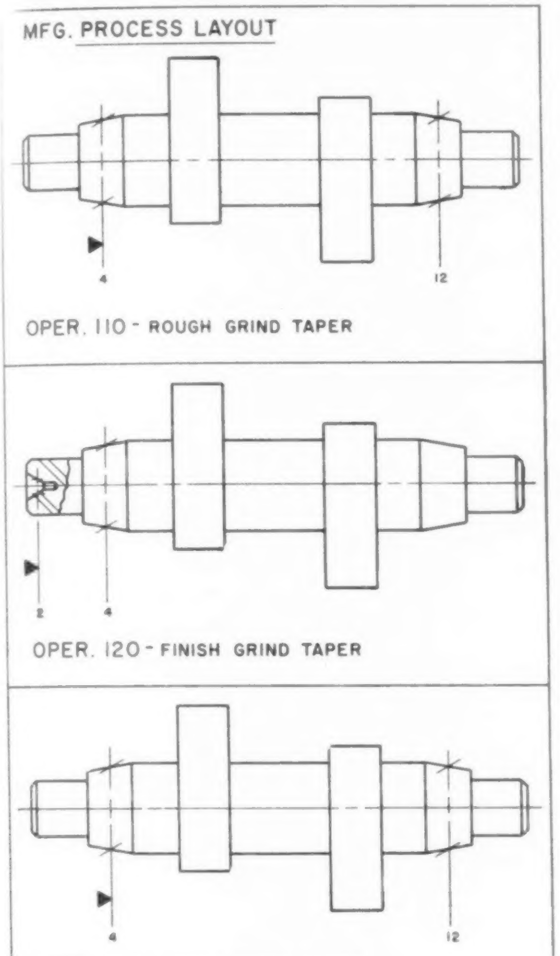


Fig. 5. The process layout is an invaluable aid during construction of the tolerance chart by the index system. A tolerance chart will be prepared for the manufacture of this hypothetical camshaft.



rocess chart continued.) The special treatment for pers holds them in correct linear position.



the smaller dimension and the lower limit of the larger one could overlap to the amount of the difference between the basic stock removal and its minus tolerance.

The following formulas determine minimum and maximum stock removals:

$$\text{Minimum stock removal} = E - \frac{F}{2} + G$$

$$\text{Maximum stock removal} = E + \frac{F}{2} - G$$

where

E = Basic stock removal
F = Total tolerance on stock removal
G = Total tolerance on working dimension

On dimension 11-15, the minimum stock removal is 0.001 and the maximum is 0.125. Aware of this condition, the tool setter will set the tool or tools at a place within that range which will produce optimum results in the component.

Indirect machining occurs when some surface other than the two covered by a given dimension is used as the locating point when machining to obtain the dimension. In Operations 100 and 120, *Fig.* 7, surface 4 is ground with surface 2 as the locating point while the actual component dimension for surface 4 comes from surface 1. All dimensions that are machined just as they appear in the index table are termed direct machining.

The quantity for dimension 2-4 can be found by the method previously described but the tolerance for this dimension is determined in a much different manner. A glance shows that distances 1-2 and 2-4 must be added to equal distance 1-4. Likewise, the tolerances on dimensions 1-2 and 2-4 must be added to equal the tolerance on dimension 1-4. Since the tolerances on dimensions 1-2 and 1-4 are known, the former must be subtracted from the latter and the difference applied to dimension 2-4.

Since the known tolerances are the same in the case just outlined, subtracting one from the other leaves no tolerance to be applied to dimension 2-4. This is not permissible, so the tolerance on dimension 1-2 must be reduced or "cut" and that amount applied to dimension 2-4, the proportions depending on the type of operations involved. If the tolerance on dimension 1-2 were already so small that a cut would be impractical, some other means of machining or another point for locating must be used.

Possibility of such conditions indicates that indirect machining should be avoided whenever possible. Every time a tolerance is cut, the expense of performing that operation and the scrap resulting from it are increased.

The foregoing procedure serves to introduce another term, "balance dimension." A balance dimension is either (a) the difference between two working dimensions or (b) the sum of two or more working dimensions. Balance dimensions are used

for reference throughout preparation and checking of the chart. A balance dimension is required prior to each working dimension where neither a previous balance nor working dimension gives the previous size of that working dimension.

The functions of a balance dimension are two-fold. First, when indirect machining is used, the resulting balance dimension must equal the same dimension on the component drawing, thus assuring the use of proper tolerances and providing a check on the mathematics of the problem. In the description of indirect machining, working dimensions 1-2 and 2-4 and their tolerances were added and the resulting balance dimension of 1-4 was used as a reference to check that dimension in the index table.

Second, balance dimensions provide successive reference points from which stock removal amounts and tolerances can be figured. For example, stock removal is found for dimension 2-4 in Operation 100, *Fig. 7*, by using that dimension and the balance dimension for that distance just preceding in Operation 80, subtracting the smaller from the larger and adding their tolerances. This precludes the necessity for tracing back through many working dimensions to obtain these figures. It also provides a running check on accumulated tolerances, which are obtained by adding the tolerances on all working dimensions that affect each balance dimension. The method for finding these tolerances on dimension 2-4 in Operation 80 is illustrated in *Fig. 8*.

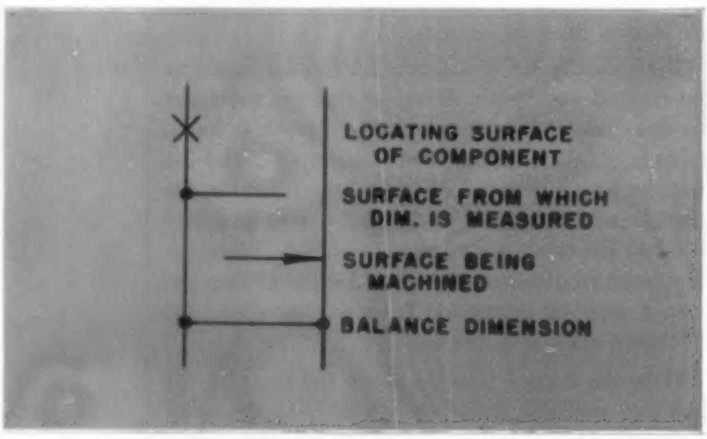


Fig. 6. Only four basic symbols are required during the construction of a tolerance chart. Other conditions of dimensioning are referred to in footnotes.

Since every dimension is bounded by two surfaces, the tolerances affecting both surfaces must be considered. The dotted lines A and B show graphically the method for finding the tolerances affecting the left-hand and right-hand surfaces, respectively. Line A starts at the left-hand end of the balance dimension and proceeds upward to the first arrow, then horizontally to that dimension's locating dot (continuing this process if more dimensions are involved). Line B starts at the right-hand end of the balance dimension and proceeds upward and horizontally the same as line A. When the two dotted lines converge, the process stops. The tolerances at all horizontal turns of both dotted lines are added and the answer is the tolerance of the balance dimension.

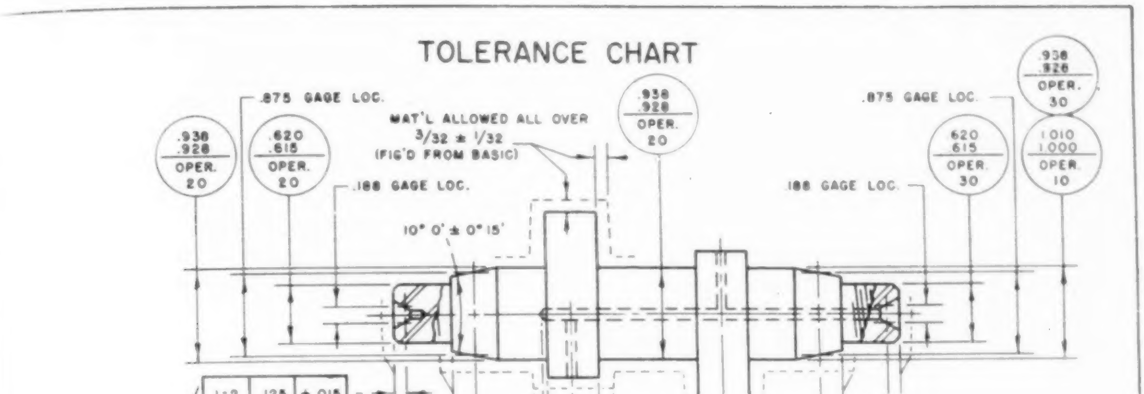
Diametral Dimensions

Mention has so far been made only of linear dimensions because the only time that a diametral dimension need be considered is when it affects a linear dimension through machining of a taper. The Index System circumvents trouble from this aspect by specifying that each tapered or angular portion of a component have as its diametral dimension a basic figure placed somewhere within the taper. This is called a gage diameter or gage location and is given a machining dimension and tolerance in the linear direction of the part. The gage location is maintained throughout successive machinings of the taper and only the linear dimension changes in each operation. The centers and angular bearing seats of the camshaft in this article are illustrative of this method.

The completed tolerance chart is shown in *Fig. 7*. The chart should be constructed in the eleven steps that follow, in the order outlined to insure correct results and simplicity of construction:

1. Draw view of part, including blank, casting or forging. Add lines for linear dimensions, and lines and balloons for diameters. Add lines and headings for all vertical columns. Add component dimensions and tolerances for both lengths and diameters. Index linear dimension lines and add index table. Check index table per *Fig. 2*. (It is advisable to make a print of the chart at this stage to use as a work sheet, since changes are made frequently during construction.)
2. Add horizontal lines dividing chart into operations, allowing ample space for both working and balance dimensions. Add operation numbers and brief description of operations, and machines if desired.
3. Add horizontal lines to indicate working dimensions in their proper sequence, working from top downward.
4. Apply tolerances only (no dimensions) to working dimension lines, working from top downward.
5. Apply basic stock removal amounts only (no tolerances) to all working dimensions where stock removal occurs, working from bottom

TOLERANCE CHART



INDEX TABLE

1-2	.125	±.015
1-3	.625	±.015
1-4	.875	±.015
15-13	.625	±.015
1-7	1.875	±.015
1-10	3.625	±.015
15-5	3.937	±.015
4-6	.719	±.002
4-8	1.281	±.002
4-9	2.469	±.002
4-11	3.031	±.002
4-12	3.750	±.001
2-14	5.250	±.002
1-15	5.500	±.015

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

OP. NO.	OPER. DESCRIPTION	DIM. INDEX	WORKING DIM.	WORKING TOL.	BALANCE DIM.	BALANCE TOL.	STK REM'L DIM.	STK REM'L TOL.
10	SPOT DRILL, TURN & FACE	6-11	2.437	±.005			.063	±.067
		11-15	1.594	±.005			.063	±.072
		11-1			4.031	±.067		
20	SPOT DRILL, CHAMFER, TURN, FACE, FORM & THREAD	11-1	3.937	±.005			.094	±.072
		1-3	.625	±.015			SOLID	
		1-4	.809	±.010			SOLID	
		4-11			3.128	±.015		
		1-6	1.588	±.003			.088	±.044
		4-6			.779	±.013		
		1-8	2.162	±.003			.088	±.044
		4-8			1.353	±.013		
		1-9	3.338	±.003			.088	±.044
		4-9			2.529	±.013		
30	DRILL, CHAMFER, TURN, FACE, FORM & THREAD	1-15	5.500	±.015			.031	±.023
		1-11	3.912	±.003			.025	±.008
		4-11			3.103	±.018		
		1-12	4.691	±.010			SOLID	
		4-12			3.882	±.020		
		15-13	.625	±.015			SOLID	
		15-5	3.937	±.015			SOLID	
50	DRILL 2 OIL HOLES	1-7	1.875	±.015			SOLID	
		1-10	3.625	±.015			SOLID	
60	CENTER BOTH ENDS	1-2	.125	±.010			SOLID	
		2-14	5.250	±.002			SOLID	
		2-4			.684	±.020		
100	ROUGH GRIND TAPER AT LEFT	2-4	.732	±.010			.048	±.030
		1-4			.857	±.020		
		4-6			.731	±.023		
		4-8			1.305	±.023		
		4-9			2.481	±.023		
		4-11			3.055	±.023		
		4-12			3.834	±.030		
110	ROUGH GRIND TAPER AT RIGHT	4-12	3.786	±.010			.048	±.040
120	FINISH GRIND TAPER AT LEFT	2-4	.750	±.005			.018	±.015
		1-4			.875	±.015		
		4-6			.713	±.018		
		4-8			1.287	±.018		
		4-9			2.463	±.018		
		4-11			3.037	±.018		
		4-12			3.768	±.028		
130	FINISH GRIND TAPER AT RIGHT	4-12	3.750	±.001			.018	±.028
140	GRIND LEFT SIDE OF CAM LOBES	4-6	.719	±.002			.006	±.020
		4-9	2.469	±.002			.006	±.020
150	GRIND RIGHT SIDE OF CAM LOBES	4-8	1.281	±.002			.006	±.020
		4-11	3.031	±.002			.006	±.020

Fig. 7. Complete tolerance chart for the hypothetical camshaft whose sequence of operations is shown in *Fig. 5*. All information has been checked and adjusted.

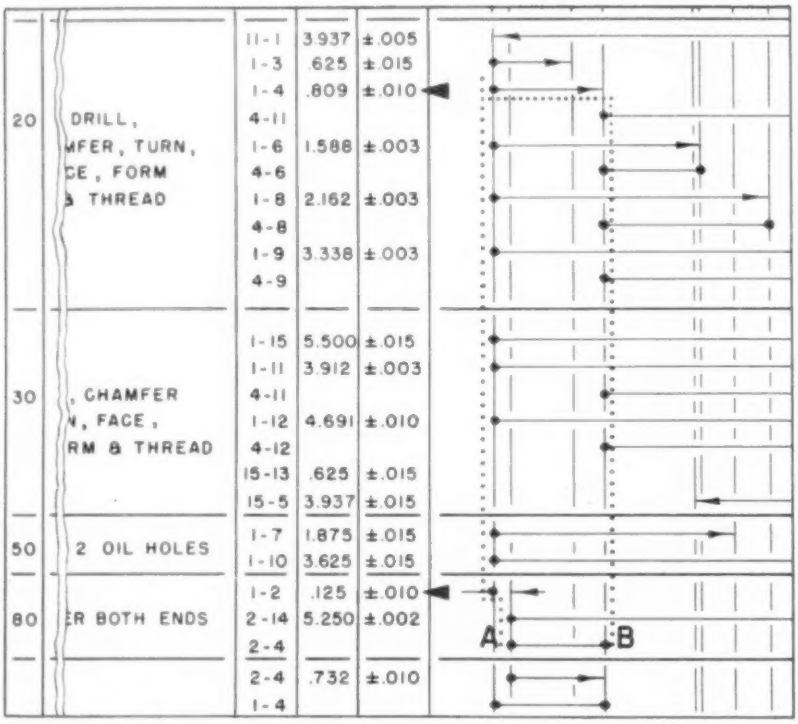


Fig. 8. Section of the tolerance chart illustrating how a running check can be made on accumulated tolerances.

upward. Insert the word "solid" where no stock removal occurs.

6. Insert horizontal lines for balance dimensions and apply tolerances only (no dimensions), working from bottom upward. To add these tolerances, work from top downward.
7. Compute tolerances for all stock removal dimensions, working from top downward.
8. Check chart at this stage to be sure that no undesirable conditions exist relative to maximum and minimum stock removals. Necessary adjustments should be made at this time.
9. Insert basic values for working and balance dimensions, working from bottom upward. (When calculating a balance dimension, two working dimensions or a balance and a working dimension may be involved, but never two balance dimensions. Obtain the basic value for the balance or working dimension that precedes each working dimension by adding to or subtracting from that working dimension the stock removal at that point, observing whether the dimension increases or decreases to determine which function to use.)
10. Insert dimensions and operation numbers in balloons representing diameters.
11. Double-check all aspects of the tolerance chart.

Chart dimensions are checked against the component dimensions by searching for the index of each component dimension in the dimension index column, working from the bottom upward. As each such index is reached, the balance or working dimension at that point should equal the component dimension having the same index. The only deviation from this may occur when the component drawing specifies that its dimensions are "before plating" or before some related treatment.

Additions to Chart

Although they are not included in the sample tolerance chart, there remain four types of "machining" that should be described. These are: polishing, lapping, plating and heat treating, where the latter will affect the part, either in growth or shrinkage, enough to be included in the calculations.

The first two are stock-removing operations but they differ from common chip-removing operations because the surface being polished or lapped has no definite locating point. Such surfaces can be tied in with that surface on the part whose relation to the lapped or polished surface is most important or can withstand the least dimensional change.

Since plating adds material rather than removing it, it is entirely different from the other processes. Also, a plated surface cannot usually be tied in to any other surface because all external surfaces are usually affected by the plating. The plated surfaces could be related to some internal point, if one exists, but this would probably prove impractical since dimensional changes due to plating are either negligbile or they are allowed for in the preplated stage.

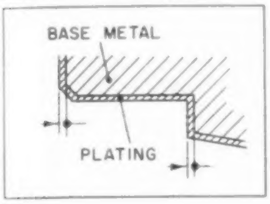
If the dimensions for plating were greatly enlarged, they would appear as shown in *Fig.* 9. This shows that the surface before plating is the locating surface and that the final thickness of the plating

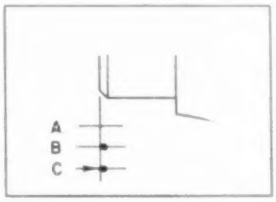
ovides the "machined" surface dimension. However, this would double the number of lines in the olerance chart and would confuse rather than clar- y the issue. A better method is shown in *Fig.* 10.

A dimension line is drawn across the surface line s at A. Then a locating dot is placed tangent to nd on the inward side of the surface line as at B, fter which an arrow is added on the opposite side of the surface line, as at C, to indicate the side of he surface receiving the plating. After each plated

Fig. 9. (left) Exaggerated view of a part showing what happens when a metal plate is applied. The initial part surface locates the final plate.

Fig. 10. (right) Preferred method of indicated plated surfaces on tolerance chart constructed in accordance with the index system.





surface is so dimensioned, balance dimensions are inserted in the chart, one for each dimension on the original component drawing that the plating will affect.

A typical plating operation is shown added to the tolerance chart in *Fig.* 11. Only those sections of the chart have been included that are used to calculate the balance dimensions, which is done as follows: The plating thickness is considered a working dimension and is inserted in the appropriate column. Beside it, a dash is drawn in the dimension index column to indicate that there is no definite locating point for the plating.

The plating will build up perpendicular to the surface of the base metal, so the build-up on an angular portion, measured in a linear direction, is found by dividing the mean plating thickness and its tolerance by the sine of the surface's angle to the axis of the part. These values are recorded on the chart.

The plating thickness is then added to or subtracted from each surface of the last previous working or balance dimension having the same index as the balance dimension being calculated. The plating arrows on the chart indicate whether addition or subtraction should be used. When the plating arrow appears on the outer side of either surface of the dimension in question, the plating dimension is added. When the arrow appears on the inner side, the plating dimension is subtracted.

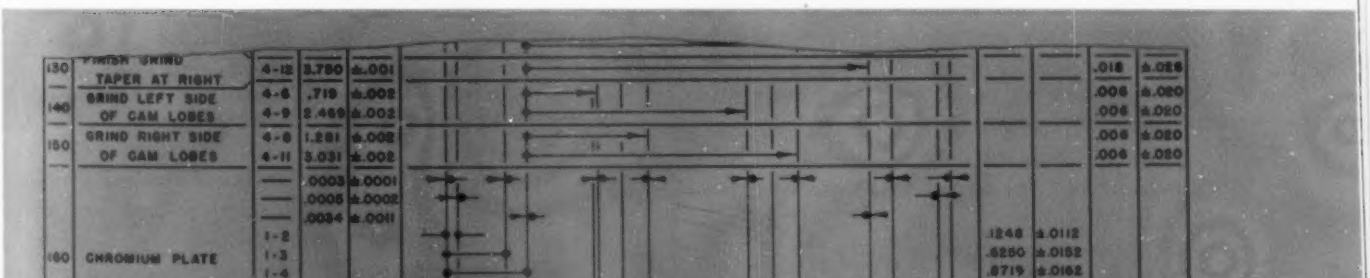
With these rules in mind, note that dimension 1-3 has the same value after plating as before, because the plating affects both surfaces in the same linear direction. However, the tolerance has increased.

Checking the balance dimensions in Operation 160 against the component dimensions, it is found that they are outside of those component dimensions. Obviously this is permissible only if the component dimensions are specified as "before plating." If they are specified as "after plating," the previous dimensions must allow for the plating.

Dimensional changes resulting from heat treating a part must be considered in an entirely different manner from those caused by plating or stock-removing operations. The general term heat treating is here used to include hardening, tempering, freezing and related operations.

Most stock-removal operations have definite locating points and plating is controlled to given thickness dimensions. Neither condition exists in heat treating. When growth or shrinkage takes place in a heat-treated part, the amount of this change is spread over its entire length. The uni-

Fig. 11. A typical plating operation has been added to the tolerance chart of *Fig.* 7 and shows the method of dimensioning that should be used.



formity of this change from one end to the other depends on the uniformity of cross section of the part. For general purposes, the change is usually so slight that it can be considered to be uniform throughout. Each linear dimension can then be assumed to change in proportion to its relation to the total length of the part.

Linear dimensions, as changed by heat treating, can be simply calculated by establishing a constant. This constant is determined by dividing total growth or shrinkage by over-all length, to find growth or shrinkage per inch, and adding one (1.000). Each dimension of the component is multiplied by this constant. It is important to remember that shrinkage is figured as a minus quantity and growth as a plus quantity. Generally, the variation in the amount of change due to heat treating is so slight that no tolerances need to be considered.

Heat Treating

To include the heat treating information in the tolerance chart, an asterisk is placed in the working dimension column in line with the operation number and referred to a note beneath the chart showing the calculated constant. Then, multiplying the value of each component dimension just prior to heat treating by the growth or shrinkage constant will establish balance dimensions for the same. As with plating, these balance dimensions can be outside of the original component dimensions only if the drawing specifies them as "before heat treatment."

Two peculiar conditions can arise during preparation of a tolerance chart. The first is when an internal and an external surface are so nearly in line that the first surface appears to one side of the second in the rough stage and to the other side in the finished stage. This condition is shown in Fig. 12. In the rough stage, distance 1-3 is less than dimension 1-2. Distance 1-3 at this point is the sum of dimension 1-2 and 2-3 minus the basic stock removal between the rough and finished stages of surface number 3.

Stock Removal

The second condition occurs when it is desirable to remove a constant amount of material from a surface, such as the removal of carburization before hardening, or when a surface to be ground requires a small wheel that cannot withstand a great variation in the amount of stock removal.

Constant stock removal is obtained by locating on the surface to be machined, such as by bumping that surface or by locating with a shuttle or spider that is removed after the part is clamped in the machine. This type of setup dictates that both the locating surface and the surface being machined bear the same index number and that the stock removal is also the working dimension for that index.

A typical part and its manufacturing sequence, plus the formation of the solution to a typical problem (find distance 2-3 after removal of carburization on surface 3) are shown in *Fig.* 13. The minus sign for dimension 3-3 was determined by examining the part drawing to see whether machining would increase or decrease the dimension in question.

In conclusion it must be emphasized that no conditions that are contrary to good machining practice should be permitted in a tolerance chart. The chart is not an end in itself but rather a means to an end: that of proving the practicability of a selected manufacturing process.

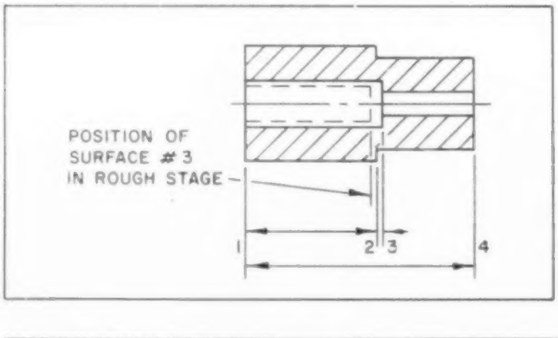


Fig. 12. (left) An oddity of tolerance charting is shown by this example where surface 3 is on one side of 2 in the rough state but on the other side in the finished condition.

Fig. 13. (below) A typical part and its manufacturing sequence illustrates the method of handing constant stock removal on a tolerance chart.

		1-2	.500	±.005				
		1-3	.750	±.007				
OP. NO.	OPER. DESCRIPTION	DIM. INDEX	WORKING DIM.	WORKING TOL.	BALANCE DIM	BALANCE TOL.	ST'K. REM'L. DIM.	ST'K. REM'L. TOL.
10	FACE, TURN & CUT-OFF	1-2	.500	±.005			SOLID	
		1-3	.760	±.005			SOLID	
20	CARBURIZE							
30	REMOVE CARBURIZING FROM SMALL END	3-3	.010	±.002 *			.010	±.002

* BUMP TO LOCATE ON SURFACE TO BE MACHINED

FORMATION:

1-2 = .500 ±.005
1-3 = .760 ±.005
2-3 =
3-3 = .010 ±.002
2-3 =

SOLUTION:

−1-2 = .500 ±.005
1-3 = .760 ±.005
2-3 = .260
−3-3 = .010 ±.002
2-3 = .250 ±.012

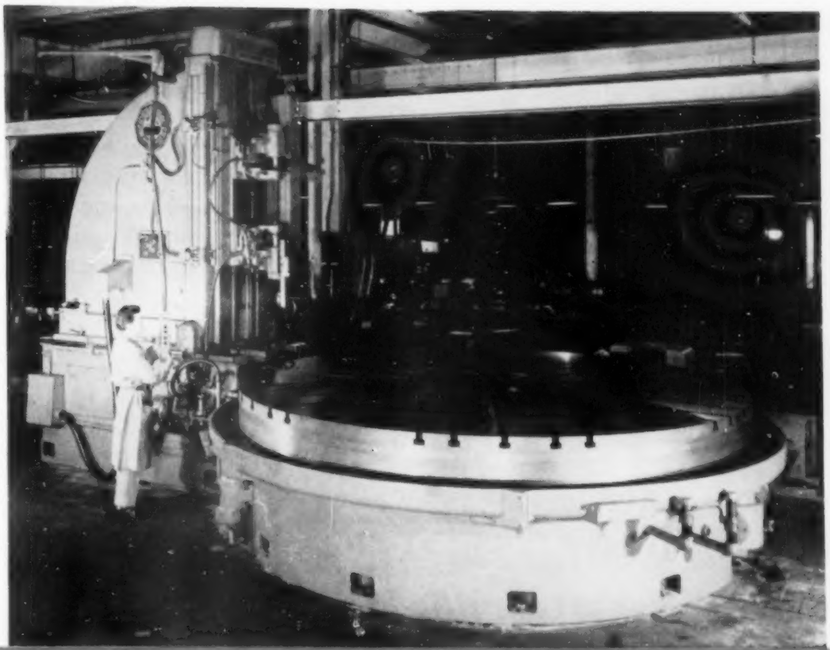


Fig. 1. In use before scraping of the main casting, strain gages permanently cemented around the base of this horizontal shaver insure proper leveling facilities throughout the life of the machine.

STRAIN GAGE LEVELING

increases machine accuracy

By Harry Pelphrey*

Research Engineer
Michigan Tool Co.
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CONVENTIONAL METHODS of leveling large machine tools overlook the effects of stresses that can be set up in a machine because of its own weight and the weights of large workpieces. Leveling with strain gages, however, assures continued accuracy of large machines, *Fig.* 1, by measuring these stresses so they can be equalized. Uncorrected stresses often result in a corrugating effect in the worktable making adherence to close tolerances difficult.

Formerly, large machines were leveled during erection at the builder's plant by using precision spirit levels and leveling jacks. Machines were then partially or totally disassembled, shipped to the customer and leveled in position by a repetition of spirit level techniques.

Application of strain gage measuring techniques for equalizing the load on beds and bases of large machines helps to guarantee the continuance of accurate work during the life of the machine. Strain gages should be applied to any machine large enough to require the concrete foundation to act as an essential part of the base. This fact rules out their use on rubber or felt pad mounted machines.

Principles of strain gage operation are relatively simple. An indicator records the flow of current through a small calibrated-wire SR-4 strain gage. If under tension, the wire diameter decreases and current flow diminishes, under compression, wire diameters increase and current flow increases. Readings are indicated in micron (millionths of an inch) deflections per inch.

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Primarily used during construction, erection and location of new machines, strain gage techniques can also be applied when relocating existing machines. Major advantages resulting from strain gage leveling methods include:

(1) A balanced stress condition around a large machine base supported by conventional leveling jacks.
(2) Stress conditions under which the machine is originally assembled can be duplicated in the user's plant.

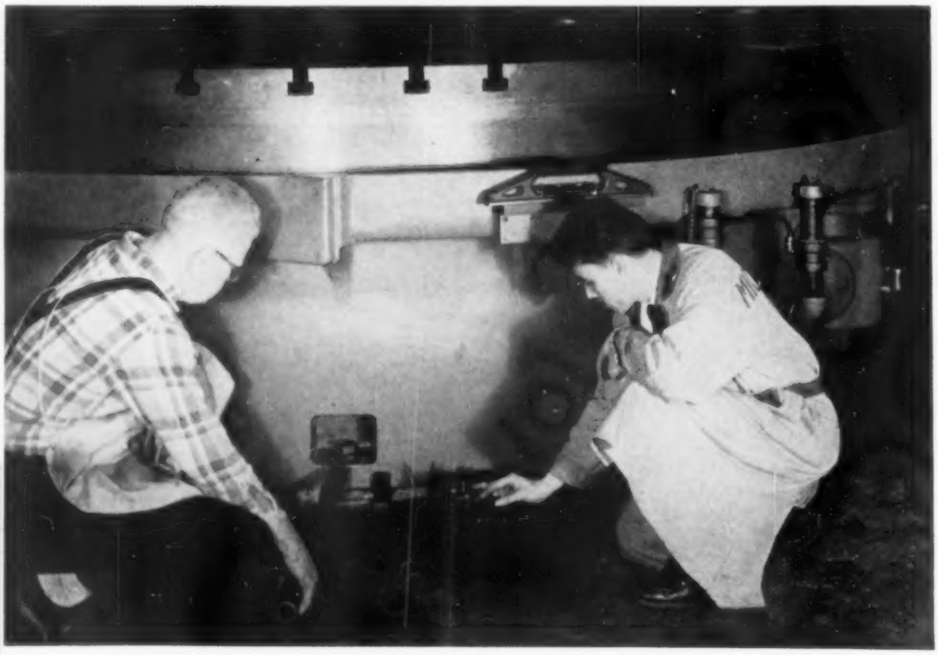


Fig. 2. After initial leveling with the precision spirit level, and the taking of double strain gage readings at each leveling jack, a two-man team makes final leveling jack adjustments to equalize the stresses.

(3) Strain gages can be used to restore original conditions if the concrete foundation settles after the machine has been in operation.
(4) In the event the machine has to be moved within the plant, it can be correctly set up in the new location.

Use of strain gage techniques starts before final machine erection. The first readings are taken after the main casting is machined and leveled but before it is scraped. Starting at this point insures that the casting is scraped without any initial stresses present and that the scraped bed will remain level.

The builder uses a precision spirit level to level the completed machine and then takes strain gage readings at each leveling jack location. A reading is taken with the leveling jack supporting weight and a second reading is taken after the leveling jack is backed off so that all strain is removed. In this manner a differential reading between the free and weight bearing conditions is obtained at each pad.

Differential rather than actual indicator readings are used to equalize the strains around the machine base. When all readings have been taken, adjustments are made, *Fig.* 2, to level out the differentials by tightening level jacks at points of minimum differential and easing off jacks at points of maximum differential. Adjustments are usually made to within ten percent of the average differential at each pad location.

All readings taken on a perfectly symmetrical machine would be identical within the limits of the strain gages. Since machines usually have a column, table, motors and other unbalancing units, readings seldom are similar. However, equally weighted points on opposite sides of a machine should have the same reading.

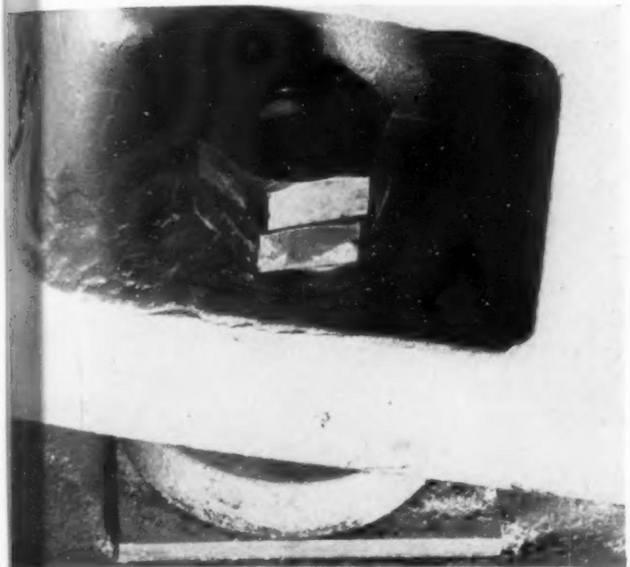
Permanent Part of Machine

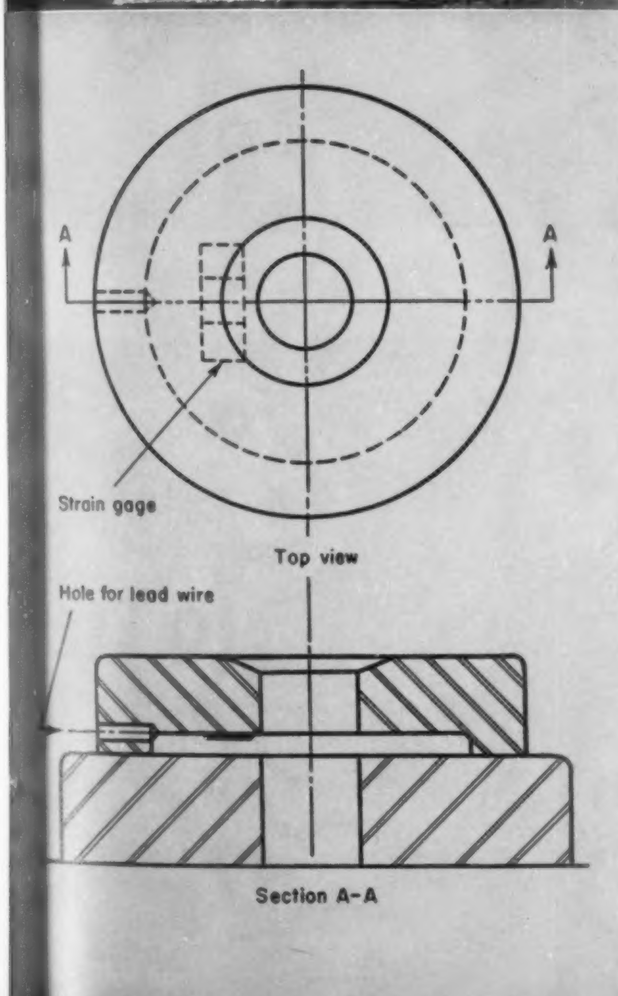
After the equalizing process is completed, readings are recorded, and the strain gage leads are disconnected, rolled up and taped in the leveling jack cavities. The paper-backed strain gages, *Fig.* 3, are cemented into position in the fillets of the jack bosses and remain permanently attached to the machine. This positively insures that all strain gage readings will be taken at precisely the same locations, and avoids any discrepancies that might be introduced if different strain gages were mounted for each set of tests. The strain gages are protected by a thick coating of wax.

On arrival at the plant, the machine is set up, leveled by checking key locations with a precision spirit level, and finally adjusted by turning the leveling jacks until the strain gage readings specified are achieved. Strain gage leads are again disconnected and the machine is ready for operation. If at any time after starting the machine, there is

question of its levelness, the strain gage leads be connected to an indicator and all readings be checked. Discrepancies introduced because any reason can be eliminated by adjusting the leveling jacks to achieve initially specified strain gage readings.

When a machine is also supported at its center, strain gages may be required near the support to insure proper leveling. The horizontal shaver has center support plates with a strain gage fastened to the underside of the top plate, as shown in *Fig.* 4. Deflection in the top plate is measured by the strain gage. The amount of deflection around the center will be almost constant because the machine is symmetrical about this point. Although this type of installation is not as accessible as that possible at the leveling jacks, it is important to insure proper machine alignment. The shaver described has a 160-inch diameter worktable and was initially erected to run with table diametral runout of no more than 0.0003 inch and an equal face runout. The machine was leveled in the plant to the same limits and produces parts within tolerances of 0.0003 inch.





Relocation Checking

Although the technique of using strain gages was developed for setting up machines as they are initially erected, it can also be adapted to checking existing machines. The main difficulty with this is that the manufacturer's checkpoints and strain gage readings would not be available. Greatest value of this technique with existing machinery is probably found when relocating machines. Readings taken at the old location, where the machine was operating satisfactorily, could be used as references for setting up the equipment at the new position.

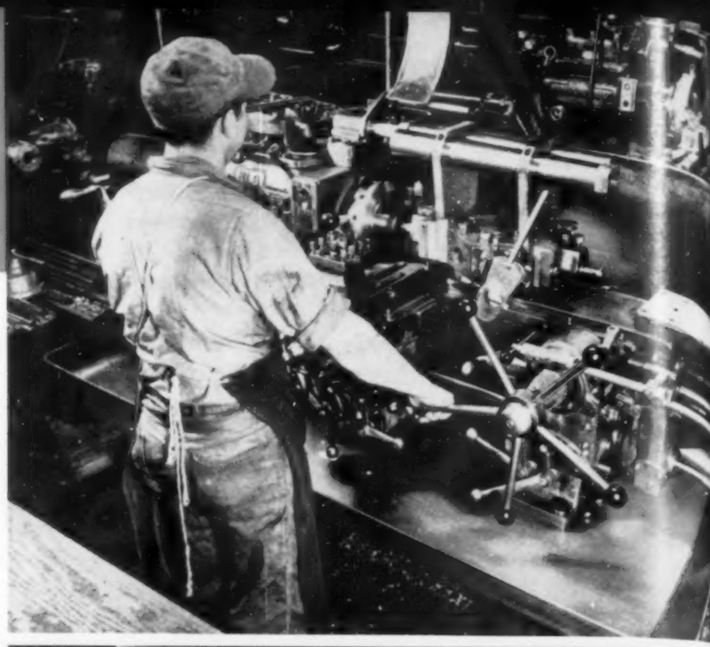
To complete the half of the Wheatstone bridge circuit containing the strain gage mounted at the fillet, a compensating gage is added. This dummy gage is mounted on a steel block placed on the floor near the machine base to insure that both strain gages on one side of the bridge are at the same temperature. The other half of the Wheatstone bridge is completed in the strain gage indicator, also used near the machine base.

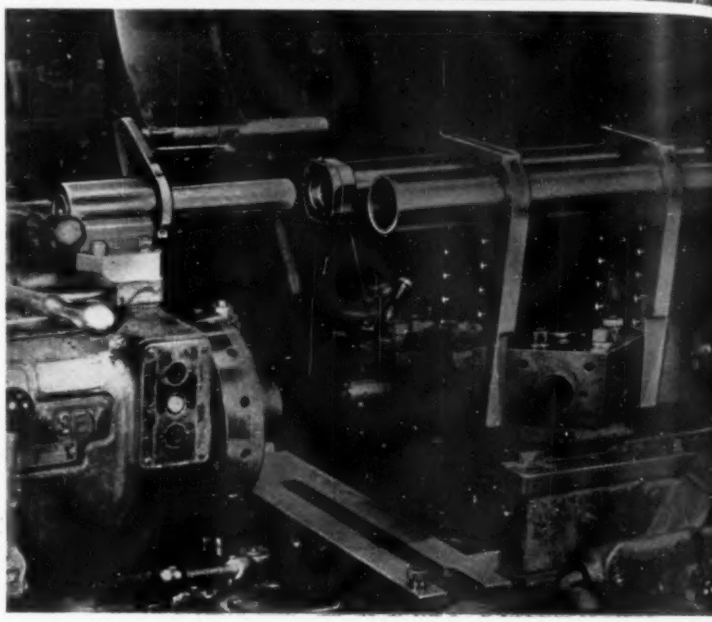
Strain gage techniques for leveling large machine tools should not be regarded as short cuts. Machines must still be set up carefully and, although the leveling operation is simplified, time is required to bring the strain gage readings into balance. Changes at any one leveling jack will introduce changes at adjacent strain gages, and will require readjustment of these jacks. Application of strain gage techniques for setting up a large machine, helps to assure high quality production by lessening machine inaccuracies. When considering this advantage, the time spent in positioning the machine is not too important a factor.

Fig. 3. (above) Close-up of leveling jack boss shows how the strain gage is permanently cemented to the fillet. It is covered with wax to protect it from moisture, oil and dirt.

Fig. 4. (below) Diagram of central support of the shaver shown in *Fig.* 1 illustrates the method of placing the strain gage.

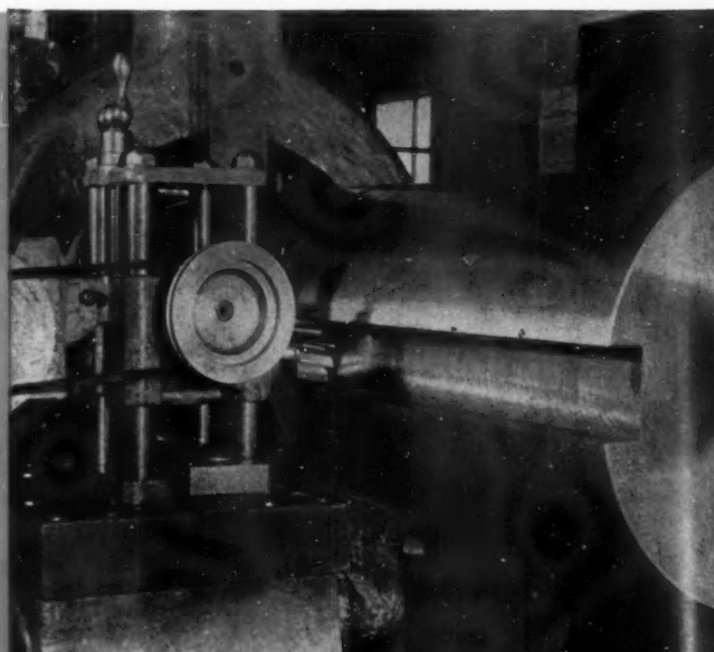
TOOLS at work



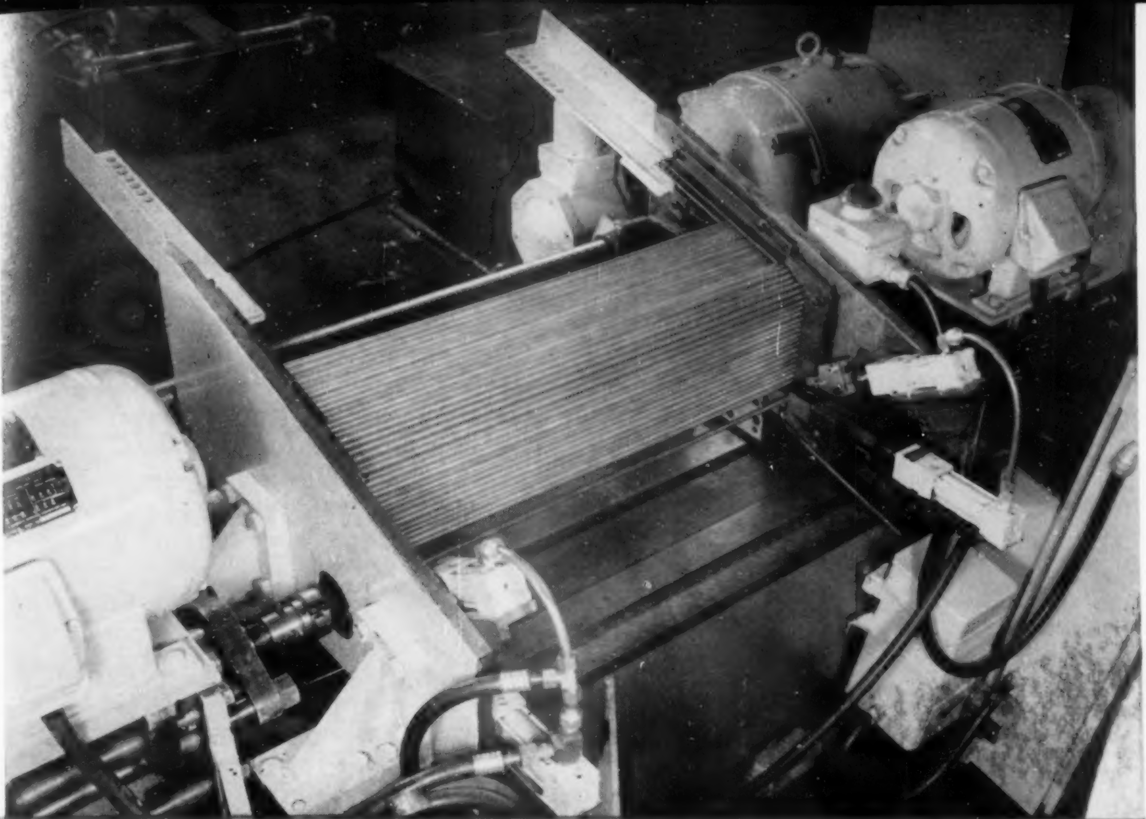


VIBRATION CHATTER (upper right) is eliminated by means of a pilot bar setup in this production boring operation on a ram type turret lathe. An aluminum pulley is being bored to 1.377 inches plus or minus 0.0002 inch.

CONSIDERABLE DIFFICULTY was experienced and a high rate of rejection occurred before the Viking pilot bar unit, shown in detail in the close up, at right, was installed. Support is now provided for the turret in two positions. Precision alignment is established on each setup by loosening four cap screws on the bushing, advancing the turret until bushing and tube slide over the pilot bar, then retightening.

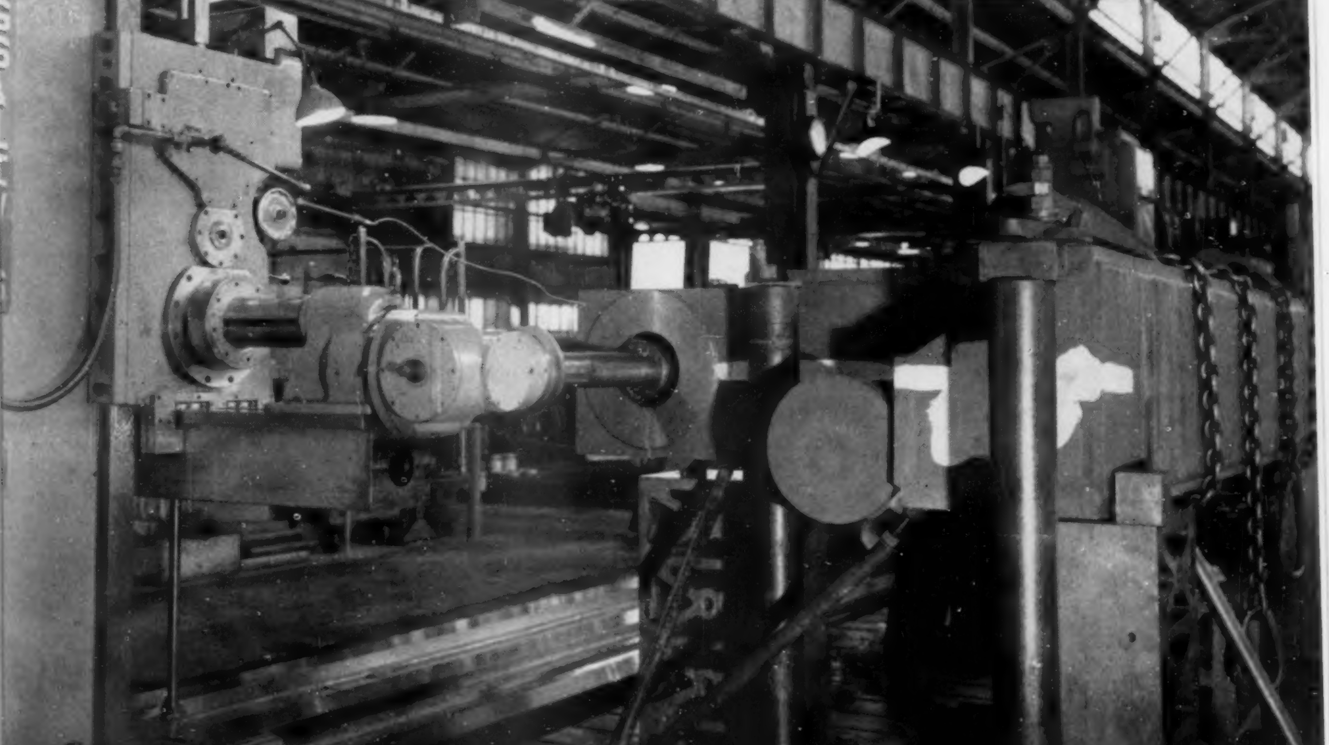


CUTTING A SPLINE $2\frac{3}{4}$ by $1\frac{7}{8}$ by 24 inches in a 16-ton crank, held in the lathe in which it was turned, was made possible by the Versa-Mil attachment shown. The job, calling for four such splines, was completed at Oakland Industries, Detroit, in less time than would have been needed to set it up on a boring mill. A $2\frac{3}{4}$-inch diameter shell end mill made each cut in a series of 15 passes. The entire operation was finished in under 16 hours.



CHAMFERING BOTH ID and OD and facing both ends of a $\frac{5}{8}$-inch metal tube is performed by this horizontal double-end machine designed and built by Walter P. Hill, Inc. Parts are fed one at a time and chucked by action of a hydraulic motor which controls feed fingers and chuck jaws. Air cylinders at the front act as uniform tension springs. With a part held between magazine ends, the cutter spindles are automatically positioned for length. The cutters are then fed to depth, retracted and the finished part ejected.

BORING HOLES IN LINE on a stretch press frame in the National Supply Co. plant at Torrence, Calif. An angular head is in use with an underarm support on the C & L floor type horizontal boring machine. A 12-inch diameter hole is produced in the operation with a feed of $\frac{1}{2}$-inch per minute, using a carbide cutter at a spindle speed of 200 rpm.



Magnesium Forming

Part 4—Deep Drawing and Miscellaneous Methods

By Francis L. Coenen*

General Supervisor, Tool Research Group
Pilotless Aircraft Div.
Boeing Airplane Co.
Seattle, Wash.

WHEN ADEQUATE TEMPERATURE controls are used, *Figs.* 1 and 2, QQ-M-44 magnesium sheet can be drawn to limits comparable to those for C-1020 steel or commercial yellow brass. Deeper draws can be made with magnesium alloys than with 24S-0 aluminum. No experimental draw limits are available but it is probable that the deepest single-stage draws can be made with magnesium. Forming speed is extremely important and should result in an even distribution of tension and elongation over the entire formed area of the part.

Deep Drawing

Of all the materials that are deep drawn, magnesium requires the least draw ring pressure. Satisfactory results have been obtained with cam-actuated draw rings set at one material thickness clearance. Integral gas burners have been found the most suitable for heating draw dies. Burners are easily built into each individual die. Equilibrium temperatures are readily maintained by a simple valve adjustment.

Single-stroke forming is recommended whenever possible as a guard against germination—the abnormal grain growth that sometimes occurs upon reheating a part to about 650 F after strain working has been done at some lower temperature. If temper-

Fig. 1. With adequate control of temperature, magnesium alloys can be drawn easily.

*Senior member ASTE Seattle chapter.

tures are held below 550 F, germination will not occur. During reheating for a second stroke, localized overheating above previously used temperatures often causes germination.

Rate of Loading: The slowest speed machines available should be used for deep drawing magnesium. While preliminary experimental tests on a crank press showed a negative correlation between crank speed and depth of draw of maximum blank reduction, subsequent data confirmed that drawability is improved as press speeds are reduced. Hydraulic presses are very suitable for deep drawing, particularly those that have a ram speed of ten inches per minute or less. This can be seen from the curves in *Fig.* 3.

Forming Temperature: The correct temperature for deep drawing magnesium is 575 F for a single stroke draw. This temperature is required to obtain the lowest possible yield strength in compression. Only those portions of the draw die that are in actual contact with the material being compressed need be at this temperature. For portions of the draw die where some stretching is desirable, a temperature of about 325 F is adequate. This lower temperature zone should be a short distance below the draw radius and will necessarily be the transition zone between the lines of tangency of the part, and punch and die, *Fig.* 4.

Since no metal strains are expected on the punch, elevated temperatures are unnecessary. In fact, a cool punch is desirable to maintain the highest possible tensile yield strength in the transition zone. It is only through use of a cool punch that the transition zone can be kept cool enough to prevent overstretching or tension tears. In some instances punches require water cooling to keep them at the desirable temperature of about 200 F. When punch radii are very large, slightly higher temperatures should be used.

Die Material and Size: Die configurations, sizes and materials are similar to those used with aluminum alloys except that temperature must be considered. Dies and draw rings should always be made from ferrous materials but cast Kirksite punches appear to be desirable. Kirksite punches can be readily cast with copper cooling tubes.

Attention should be given to the proper size of draw dies. Thermal expansion must be considered (see THE TOOL ENGINEER, December 1953, page 65). Punch nose radii should be as liberal as practicable; preferably ten metal thicknesses or more. Various die radii have been recommended but they are usually in the range from five to ten metal thicknesses. A 25-percent reduction has been successfully made, without wrinkling, with a die radius of about 40 thicknesses. This experimental reduction, although successful, proved that the radius was too large and allowed the transition zone to remain too hot. Extended experiments produced tensile failure as the amount of blank reduction was increased.

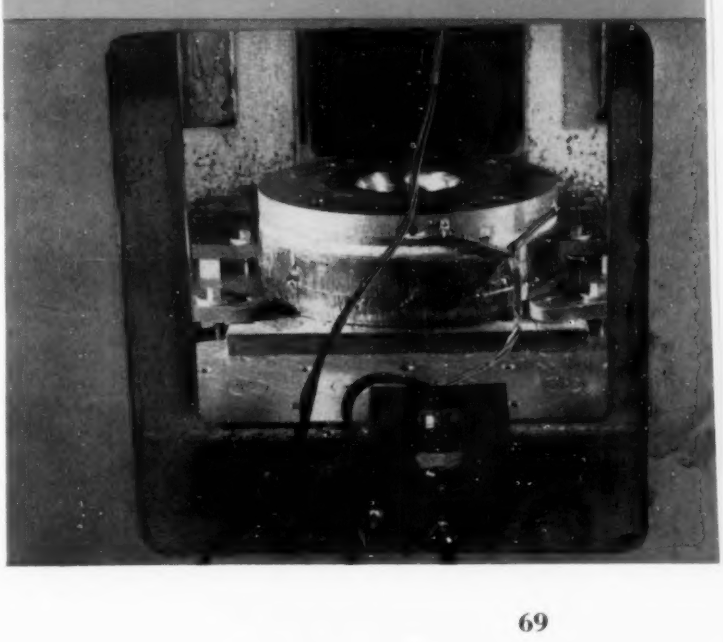
Lubrication: At the necessary temperatures, only graphite seems to be satisfactory among lubricants currently available. Not all forms of graphite are successful. Applications that tend to allow concentration of solid lubricant can induce premature wrinkling. A colloidal suspension of graphite seems to be the most satisfactory.

Miscellaneous Forming Methods

Magnesium alloy sheet stock can be formed by a number of other methods, each of which has some definite limitations. Generally, annealed sheet, when formed at room temperature, will have forming characteristics similar to 24S-T3. Hard rolled magnesium compares similarly to 75S-T6 aluminum. Both magnesium tempers can be made more formable by elevating the forming temperature.

Hand Forming: Once a part has been machine formed, little else is required. Removal of wrinkles —hand stretching of incompletely formed hydropress flanges—is an operation that requires little force. In this respect, magnesium alloys are similar

Fig. 2. Elevated temperature deep drawing die of the press setup shown in *Fig.* 1. Electrical connections are simple, and temperatures are measured by thermocouples and in indicating pyrometer.



to aluminum or steel alloys because they can be hand straightened cold without fear of failure. Room temperature hand forming, using hammers, mallets, dollies and bending bars should be restricted to two-percent elongation and one-percent compression. Shrinking operations to remove shallow wrinkles can be successfully accomplished with a foot or motor-driven shrink press.

When extensive forming must be done by hand, temperature should be raised. Since mechanical properties must be maintained, upper temperature limits should be specified according to the material involved.

Heating can be done with a small torch. Only a small area should be heated at any one time. Adequate control of temperature can be obtained through use of temperature indicating crayons. Crayons for 300 and 500 F ranges are used with hard rolled and annealed material respectively. These will allow an adequate margin of safety if time at temperature remains relatively short.

Wrap Forming: No wrap forming has been done by the Experimental Division on magnesium parts, but no difficulty is anticipated if and when this method is used. Since this type of forming is just a variation of sheet stretching, it should be practicable in the temperature range from 300 to 340 F.

Based on experience with other forming methods, it is clear that certain techniques must be followed in wrap forming magnesium: (1) wrapped parts should not be post-stretched, (2) rubbing blocks should not be used, (3) initial tension must be low to cause straining in the heated part and (4) care must be exercised in the lubrication of the wrap block.

As in hydropress work, blocks should be made of metal. Heating of the blocks can be accomplished by torches or steam, but the part need not be heated separately. Wrap form strain should be limited to 15 percent to prevent undue necking of the section being pulled.

Roll Forming: Rolling of cylindrical sections on ordinary pyramid forming rolls offers no problem. Such roll forming is usually done at room temperature. Rolling of brake formed sections and of extrusions quite frequently requires elevated temperatures. In several experimental operations heat from a hand torch was adequate to produce successful rolled forms. Heat was applied to the rolls to prevent chilling of the workpiece. The temperature of the workpiece was about 300 F and that of the rolls about 200 F at forming.

In rolling angle-sections, if the leg in the plane of the circle is in compression, there is possibility of compression failure in shear. This failure is typical of brittle material and indicates that the material was too cold at formation. Such failures do not customarily occur at 250 F or above. By increasing the temperature, the tensile yield strength is reduced in proportion to the compressive yield strength and the neutral axis moves closer to the toe of the angle. Since magnesium responds so well to stretching at 300 F, this is a good method to use when rolling inside angles.

Little Used Methods: Nothing has been said about draw bench and trip hammer forming of magnesium. The former is not recommended where elevated temperatures must be used since difficulties with galling can be expected. Better lubrication

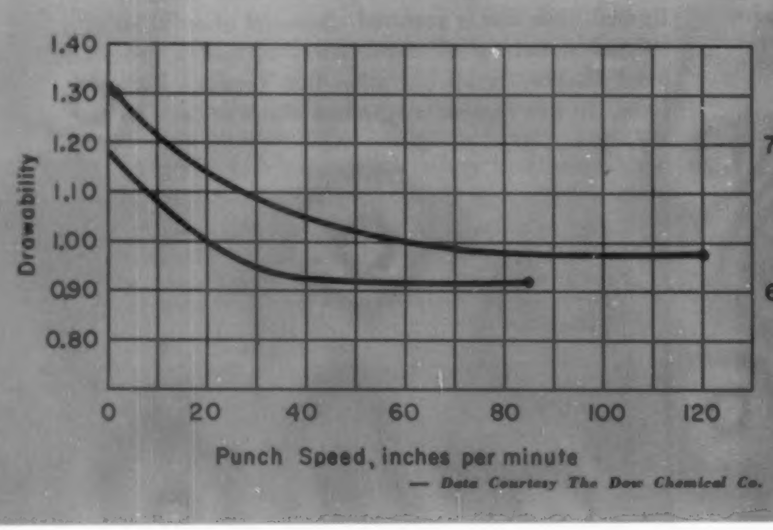


Fig. 3. Drawability vs. punch speed is here shown for magnesium alloys when a six metal thickness radius is used on the die and an eight metal thickness radius is used on the punch.

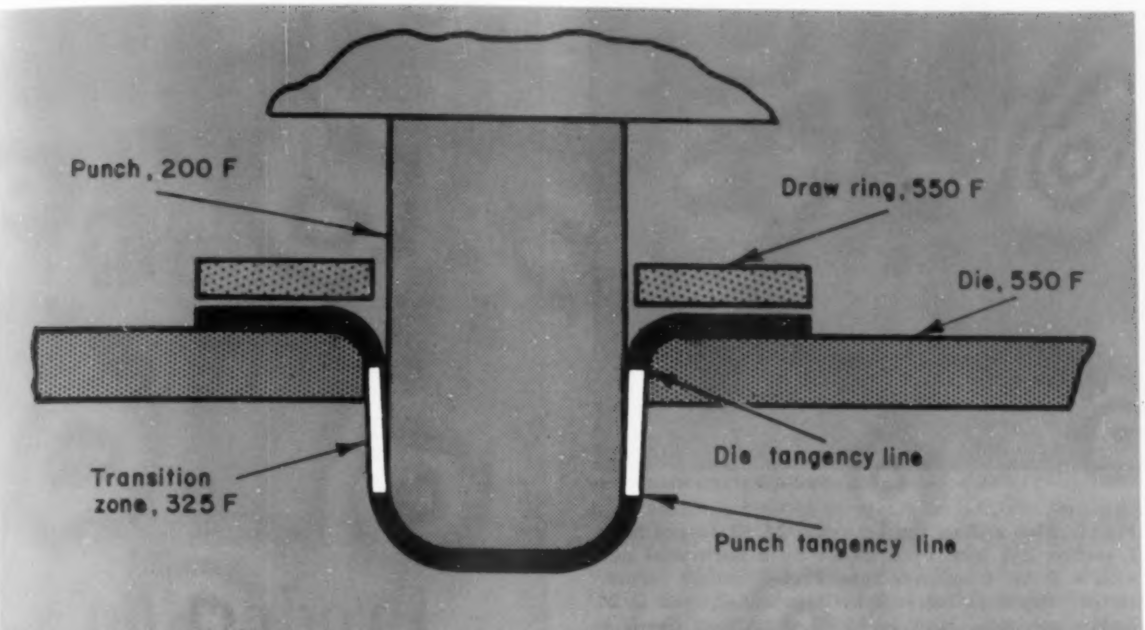


Fig. 3. Condition of ideal temperature control is illustrated for deep drawing magnesium alloys.

will have to be developed before this process can be used with any degree of success.

Trip hammer forming follows hand forming both as to limits and in requiring elevated temperatures. Rate of loading limits will prevent this process from being widely applied in production. Experimental experience has been confined to a few simple forms of relatively heavy gage. Small parts of slight contour can be produced in this way largely because the element of springback can be controlled.

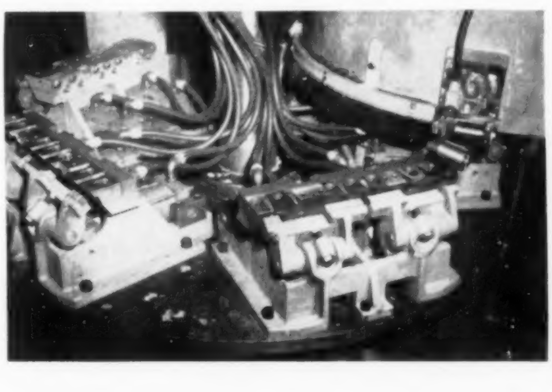
Yoder roll forming has not been mentioned because Boeing has had no experience with this equipment applied to magnesium alloys. Since spinning of magnesium alloys is eminently successful at elevated temperatures, this method of forming will be discussed in the fifth and concluding part of this series on the forming of magnesium alloys.

Production Step-up With Automatic Grinding

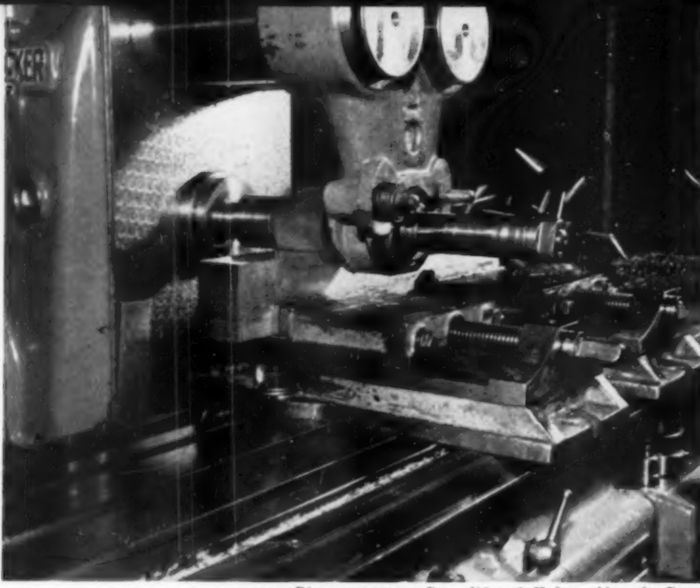
An ingeniously devised auotmatic setup has resulted in high production rates for one farm equipment manufacturer concerned with grinding replaceable plow shares.

The company adapted a Besley vertical grinder for automatic operation by equipping it with five automatic clamping fixtures which can accommodate 12, 14, 16 and 18-inch plow shares. The fixtures are mounted on a rotary table which automatically revolves beneath the abrasive disk of the grinder. As a further automatic feature, the grinder was equipped with a mechanism to compensate for abrasive wear. This adjustment also may be made manually.

It was found as a result, that as much as 1/4 inch of stock was then removed by the grinder from each share at a rate of between 350 and 400 steel shares per hour. In addition, duties of the single operator are to load and unload the clamping fixtures.



This 100 HP motor-driven grinder is claimed to be exceptionally rugged. It is recommended for finishing parts that require close accuracy coupled with high production.



—Photo courtesy Consolidated Vultee Aircraft Corp.

Fig. 1. Slab milling the base of a 24 ST forged billet L section 2¼ inch by 4 inches on a horizontal mill with a 3 by 4-inch six-flute 25-deg helical carbide cutter. Depth of cut is 1 by 2½ inches, feed is 27 inches per min, rpm is 1500. Resultant finish is better than 100 RMS.

HELICAL CARBIDE CUTTERS

Increase Production

By W. P. Strube, Jr.*

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In proper applications, helical carbide cutters have some remarkable advantages over conventional tools. They can triple machine output, cut down time for resharpening by one half and reduce considerably the handwork normally necessary to polish out cutter marks. The removal of six to eight cubic inches of nonferrous metal per minute per horsepower is feasible, *Fig.* 1. As much as 180 cubic inches per minute of 75 ST aluminum stock has been removed on a ten-horsepower Kearney and Trecker milling machine. Helical carbide tools also appear to be the answer to machining high alloy steels heat treated to 35 Rockwell *C* and above. These gains are secured at a cost of approximately 15 to 20 percent above ordinary carbide cutting tools.

The development of helical carbide tools was accelerated shortly after the end of World War II when a group of Boeing Airplane Co. production engineers began to search for means of improving spar cap milling cutters. An investigation was made of possibilities of fabricating carbide tools with faces of cutting edges ground with a true helix angle rather than a straight axial rake. At that time carbide manufacturers were unable to furnish preformed helical carbide blanks. After considerable experimentation blades were bent by hand by preheating the blanks to the molten state. In an improvement of the process blanks are brought to a controlled temperature in a high frequency induction heater, *Fig.* 2. A bending fixture is used for the actual forming. This method has been most successful in producing the desired results.

Since helical carbide tools have become available from commercial sources, *Fig.* 3, they have been adapted to an increasing number of uses. In the original application for spar milling they have been highly successful. At Consolidated Vultee Aircraft Corp., where 150 spars were formerly produced in 48 hours with a straight axial tooth carbide cutter, the time for the same operation has been reduced

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—Photo courtesy Boeing Airplane Co.

Fig. 2. One method of bending carbide, using induction heating and a bending fixture to obtain the desired helix and camber in the carbide tip. Heat required is between 2200 and 2300 F.

Fig. 3. Typical helical carbide end mill 1½-inch dia (left); 4-inch cutter for aluminum having 25-deg helix, 10-deg radial rake (right).

to 16 hours with the helical tool, *Fig.* 4. The feed was increased from 100 to 300 inches per minute. Finish obtained was considerably improved over the straight tooth cutter. This is due to the constant included cutting angle being maintained throughout the cutting cycle of each blade, which gives a uniform distribution of chipload. Additional cost of the new cutters was offset ten times on the first run and the same cutter has an additional life of several thousand more spars. Convair has now converted all new equipment and some of its present spar cap cutters to the helical carbide design in both arbor and shank types.

The company is also using helical carbide slab mills and end mills in the general machine shop wherever possible. In one application by changing from a high-speed end mill to a helical carbide cutter, *Fig.* 5, the cost of machining one piece was reduced from three dollars to nineteen cents. On this job a straight-tooth carbide cutter had been impractical. The helical tool paid for itself during the first day of operation, though several times more costly than the HSS end mill.

As costs of helical insert-type carbide cutters were reduced, a wider variety of applications have developed. End mills, slab mills, spar cap cutters and shell mills are in general use among airframe manufacturers and subcontractors in Southern California, and by at least one west coast automotive manufacturer.

Less data are available on steel applications, but this field seems to have great potential as a result of the new demands for machining steels heat treated to tensile strengths in excess of 200,000 psi. An example of such an application is found at the plant of Food Machinery and Chemical Corp., San Jose, Calif., *Fig.* 6. Bearings, speed and horsepower requirements of this type of tooling are limiting factors delaying development. As more 25 to 50-hp machines with higher speeds and better bearings are more generally available, the field for helical carbide tools for machining steel will expand. Finishes of 30 micro inches (rms) and better have been obtained on high alloy steel with tensile strength approximating 200,000 psi.

The conditions controlling usage of helical carbide tools generally are becoming better defined as experience is extended. Data are being compiled on machine limitations, speeds, feeds, horsepower, etc. In nonferrous alloys speeds of 1500 to 10,000 rpm are commonly used with corresponding feeds to control the chip within the 0.008 to 0.002-inch range to give the best performance. Horsepower requirements are from 20 to 30-percent less than for straight tooth cutters as the power required for a given cut decreases with an increase in the greater composite cutting angle attainable, i.e., the helix angle plus the rake angle. In an application mentioned earlier where 18 cubic inches of 75 ST aluminum was removed per horsepower on a cut of short duration, the motor was undoubtedly overloaded but due to the short cutting cycle no failure resulted.

The helix angle for soft steels will approximate that for nonferrous metals whereas for hardened steels the helix angle will be from ⅓ to ½ less. The rake angles for steels are neutral or negative. For specific applications, helical tools are designed taking into consideration the specific material, horsepower available, feed, rigidity and other factors, *Fig.* 3. Research is being conducted to determine the proper helix angles for various types of steel and cast iron as well as a general-purpose design applicable to these materials. Clearance angles and lands vary with respect to materials being cut in both steel and nonferrous applications.

For slab cutting on universal milling machines,

needlepoint bearings are advisable in overarm supports to insure free operation with maximum rigidity. All fixtures and setups need to be expressly designed and made with the utmost consideration given to rigidity. The checking of bearings, V-belts, bleeding of hydraulic lines, elimination of backlash, and even checking the mounting of machines to the floor, are important before placing helical carbide tools in operation.

Tool life between resharpening is much greater for the helical carbide cutters than for straight angle carbide cutters. It is estimated that production between regrinds is two to three times larger. This is attributed to the load and cutting angle being constant. In original grinding during fabrication, a fixture is used that will generate a controlled true helix angle in the face of the carbide—even correcting slight bending discrepancies. By means of the fixture the faces of the teeth are ground in relation to each other, whereas by using a cam or follower the accuracy would be correspondingly reduced.

Barring accidents it is only necessary to resharpen the peripheral clearances of the cutters, just as in regrinding high-speed steel cutters. Without the fixture for regrinding the face, a finger can be used to follow the original grind. To insure faces being lapped in relation to each other, however, it would be better either to use a fixture especially designed for the purpose or return the cutter to the maker for reconditioning. Several auxiliary machines and fixtures on the market can be readily adapted to this special grinding job. Replacement tips are also available to the user for building cutters or for reconditioning.

To date helical carbide tools have been used primarily in milling operations. They have been limited to below $\frac{3}{4}$-inch diameter where the tools could be ground from solid carbide economically, or above $1\frac{1}{4}$-inch diameter where twisted helical tips could be supported properly. New applications are being extended to such operations as drilling, core drilling and profiling.

—Photo courtesy Consolidated Vultee Aircr

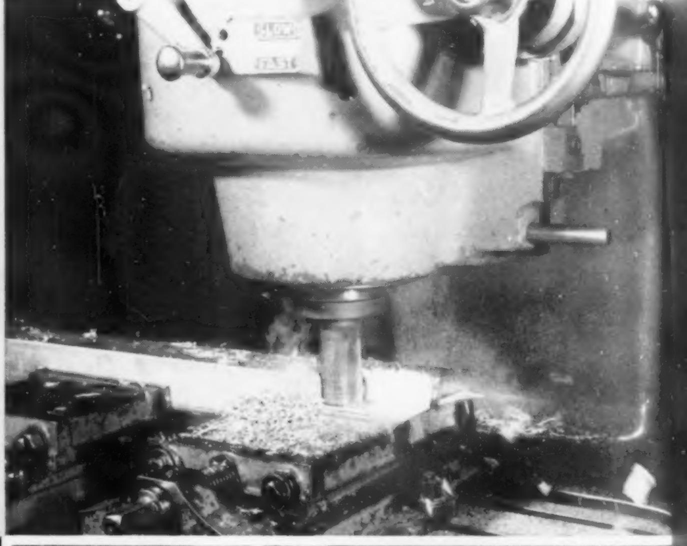
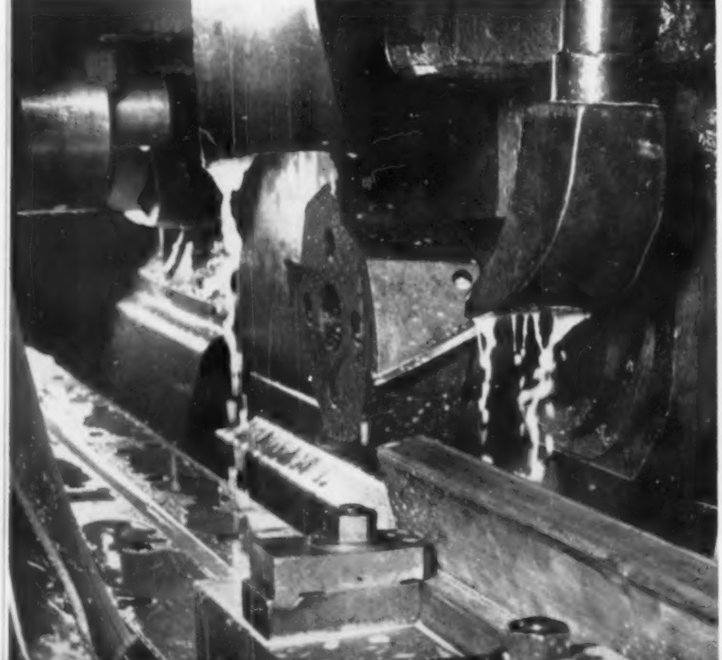


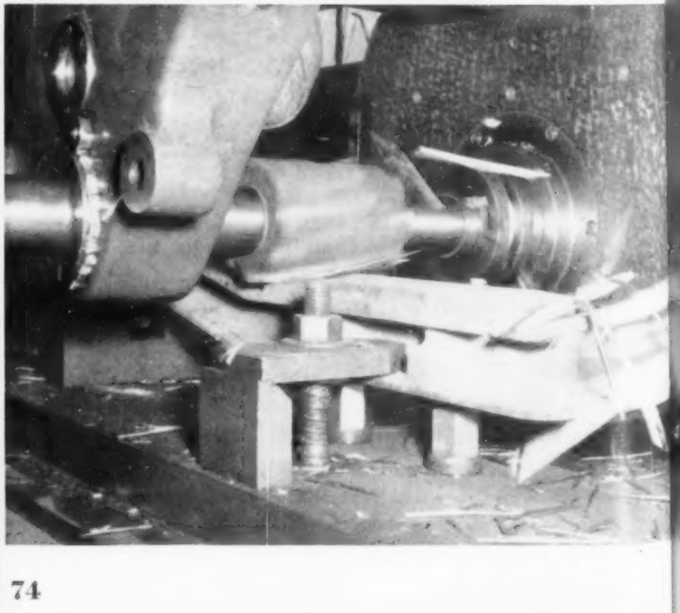
Fig. 4. (bottom left) Roughing 75 ST spar cap extrusion on 60 ft., 35 hp spar mill using $8\frac{7}{8}$ by 3-inch four-flute 25 deg helical carbide cutter. Cut is 7/16 by $2\frac{7}{8}$ inches in depth, feed 300 ipm at 3600 rpm. With the surface speed of 1570 fpm a finish exceeding 100 micro-inches is obtained.

Fig. 5. (upper right) Roughing 24 ST forged L-section on a vertical mill with a 2-inch diameter 4-flute helical carbide cutter. Depth of cut is $1\frac{1}{2}$ by 2 inches, feed 22 ipm at 1250 rpm and finish above 100 rms.

Fig. 6. (bottom right) Machining 185,000-200,000 psi steel part at Food Machinery and Chemical Corp., using helical carbide slab-type cutter with 15 deg positive true helix angle and neutral radial rake angle.

Photo courtesy Consolidated Vultee Aircraft Corp.





SPOT WELDER

retooled for greater production

By William E. Cain

Sciaky Bros., Inc.
Chicago, Ill.

Fig. 1. (above) Original setup for spot welding stainless fire boxes employed standard tooling except for slight change in lower electrode.

Fig. 2 (below) Roll spot welder would have provided revolving upper electrodes to rotate the workpiece.

Many resistance welding applications can be re-examined for better, more economical processing. Often, procedures are adopted in haste using existing facilities. Experience has shown that quality can be improved and processing costs reduced if these initial setups are analyzed with that thought in mind. The following illustrates an analysis of an actual problem and how the solution was developed.

A manufacturer of stainless steel furnace fire boxes originally set up for spot welding operations as shown in *Fig.* 1. Welding equipment was available for the job. Initial production requirements were low. The only tooling change required for welding the various diameters and lengths with a standard spot welder was substitution of a special lower horn and electrode holder for the standard horn and holder originally supplied.

As the manufacturer's production schedules increased, it became obvious that either equipment must be doubled, or a more efficient process must be developed. In re-examining the problem, several methods were considered, including the following:

Flash Welding: The ratio of wall thickness to outside diameter was considered to be too great for flash welding and resulting equipment costs would be prohibitive. Consequently, the use of flash welding equipment was rejected.

Roll Spot Welding: The use of roll spot welding was next considered. A roll spot welding machine with a special idling lower wheel and horn, *Fig.* 2, offered several advantages including a slight increase in productive speed, because the driven upper electrode wheel would rotate the workpiece. An improvement in quality of the product would be secured because weld spacing would be consistent.

The configuration of the workpiece made it impractical, however, to roll spot-weld both joints simultaneously on all sizes of firebox assemblies

with one lower tooling arrangement. The additional problems of driving both upper wheels at the same circumferential speed, conducting current to both upper heads and providing adjustable spacing between electrode wheels were serious enough to rule out the use of roll spot welding. Furthermore, the gain in productivitiy was insufficient to warrant the expense involved.

Multiple Spot Welding: Multiple-electrode multiple-transformer equipment was also studied, but finally rejected because a small diameter access hole at the top of the box was too small to admit a large expanding mandrel inside the assembly. The ues of such equipment for welding the bottom to the shell, before attaching the top, was considered but was rejected because additional handling time wiped out any saving in welding time.

Dual Electrode Spot Welding: After investigation of the methods described previously, it was finally concluded that dual spot welding would achieve the greatest productivity with the best weld quality at the lowest cost per assembly welded. Also, this arrangement would be the easiest to change over for the various sizes of boxes to be welded.

The tooling finally developed is shown in *Fig.* 3. This setup offers many advantages. Two separate heads insure consistent pressure at each electrode. The dual heads also provide for separate adjustment if the metal thickness is changed on either of the two end pieces. Use of separate welding transformers, each having its own tap switch for heat adjustment, permits adjustment of the secondary current for each electrode, despite the difference in throat depth and secondary impedance caused by the electrode arrangement. The system also provides for separate adjustment of secondary current for changes in end piece gage thickness.

Center bolted, horseshoe type, upper electrode holders make it possible to adjust the spacing between electrodes easily. The sliding lower electrode holder, mounted in a keyway in the lower arm, can also be moved easily for welding different sizes of firebox assemblies.

To support the workpiece during welding and to rotate it intermittently between welding strokes with no rubbing or dragging of work over lower electrodes, a special d-c motor driven roll-cradle fixture is used.

The weight of the fixture and drive unit is counterbalanced by air cylinders so as to lift the spot weld assembly from the lower electrodes as the upper electrodes retract.

Motor speed and motor "on" time are adjusted individually by controls mounted on the face of the welding control panel.

With this system the original production rate is almost doubled. Weld strength and spacing are uniformly consistent. The operator is only required to load the preassembled parts, initiate the welding sequence, and unload the welded assemblies.

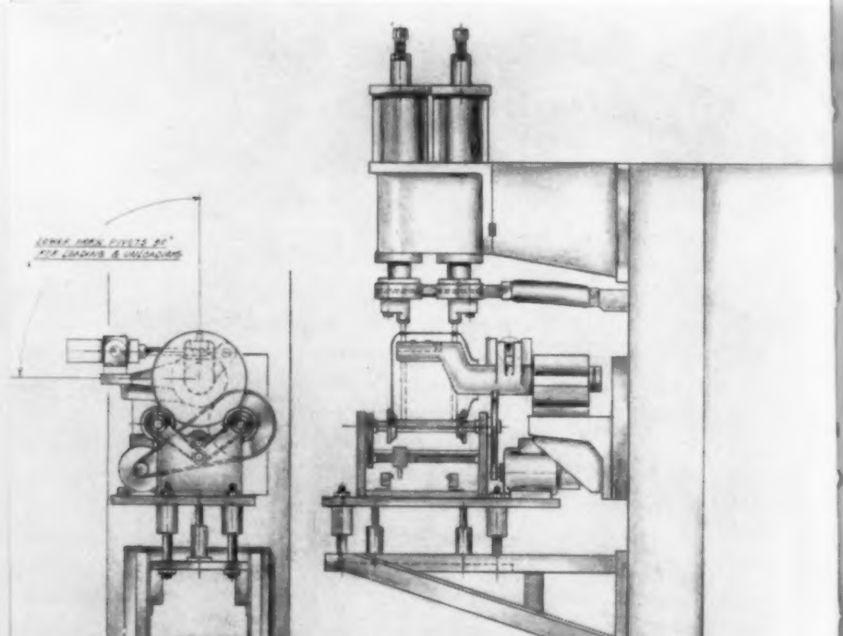


Fig. 3. Dual electrode arrangement supplies the most practical solution to problem of varying product sizes, at same time gives a more automatic operation.

investment casting

when and how to use it

By Edward Engel

Consulting Engineer
Philadelphia, Penn.

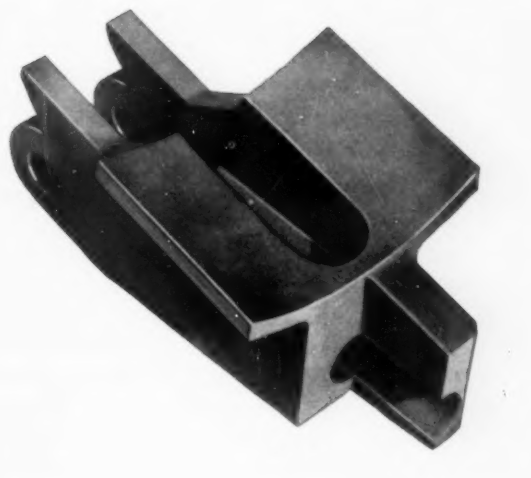


Fig. 1. One-pound pivot bodies for 57-mm recoilless rifles were formerly milled from nine-pound blocks. Invested of SAE 4140 without metal waste, the parts are now made with labor and material savings of 50 percent.

Deciding when a part should be made by investment casting is a problem that confounds many production engineers as well as designers. In numerous cases parts produced by other means, as well as designs still on the board, could be converted into investment castings resulting in lower manufacturing costs, improved design, appearance and function.

It is often thought that investment castings are merely used to replace sand castings when greater precision is required. More often, however, investment casting presents an advantage to shaping the desired part from bar stock, *Fig.* 1.

Investment Casting vs. Machining Methods: When a part is to be hogged out of bar stock or from rough sand castings, the most machinable alloy is usually selected, even though subsequent operations require other properties such as high weldability or corrosion resistance. If the part is made as an investment casting little or no consideration is necessary for machinability of the alloy. The metal with the best properties for subsequent operations or for its end use may therefore be selected.

There are few restrictions in shapes obtainable by investment casting as contrasted with parts made by other methods such as machining. For example, when other than a flat or cylindrical surface is to be developed by machining operations, the costs become prohibitive, *Figs.* 1 and 2. Again, in machining operations, curves on vertical and horizontal surfaces require expensive setups and double handling but are readily produced by investment casting. In machining operations, reliefs for otherwise long, flat surfaces require expensive setups and double handling.

The possibility of producing a part by investment casting should be investigated when: (1) expensive tooling and machining would be required, (2) an excessive amount of expensive metal must be removed, especially if the material is not an easily machined stock, and (3) more than a minimum amount of metal must be removed from a nonmachinable alloy, especilly if it is an involved shape.

Investment Casting vs. Sand Casting: If quantities involved are sufficient, investment castings serve more efficiently than small sand castings, if the part is otherwise within the scope of the investment casting process. Within its capabilities, investment casting is preferred because of reduced porosity and the greater ductility of the invested part.

Investment Casting vs. Die Casting: As a production metal-forming method, die casting of aluminum and zinc parts is in a class by itself. Investment casting cannot replace it except when shapes are too complicated to be produced economically on short or medium runs, or when dynamic loading requirements are severe. Die casting, however, is the only process at present that can incorporate movable parts within movable parts, or include inserts economically. When ferrous metals are involved, investment casting presents the only economical method for accurately casting lettering and raised or indented surfaces in designs. Fidelity of detail is comparable to that obtainable by costlier methods.

INVESTMENT CASTING VS. FORGING FOR SMALL PARTS: Small parts can be investment cast with fewer restrictions on shape and materials used than apply to forgings.

INVESTMENT CASTING VS. SHEET METAL FORMING: Stamped or drawn sheet metal parts are seldom replaceable by investment castings unless the parts are used in an assembly that could be cast as a unit.

INVESTMENT CASTING VS. JOINING OPERATIONS: Welded, brazed, soldered or riveted assemblies of formed sheet metal parts, of machined parts, or a combination of the two, should be studied to discover if the entire unit or various portions of it could be replaced by investment castings. Production economies frequently result from such redesign. The study should also consider the following results that may be achieved: (1) a sturdier design, (2) incorporation of a recess for holding brazing alloys to facilitate assembly, (3) a design that minimizes warpage of assemblies during elevated temperature joining operations and (4) other properties derived from the use of a functionally more desirable metal or alloy.

INVESTMENT CASTING VS. POWDER METALLURGY: These two processes are seldom competitive. Investment castings are better in low and medium volume production and in shapes that are intricate in both vertical and horizontal planes. Powder metal production is more economical for large volume lots and with parts that do not involve complex curved surfaces in two planes, and where there are no re-entrant angles or lateral holes and openings. Certain complex designs can be divided into individual pieces that can be easily and accurately produced by powder metallugy and later joined as a precise whole. The final composite piece has a tensile strength approaching that of mild steel and can be heat-treated to obtain strengths as high a 150,000 psi.

In certain applications, powder metal parts serv uniquely. For self-lubricating parts, such as lightl loaded bearings, and small cams, gears and sheave no other production process could be used. Th electronic industry makes use of magnets and othe powder metal parts that could not be machined o cast. In the past, impact strengths of powder meta parts were insufficient for many otherwise idea applications, but parts presently produced offer sufficient strength for such uses as lawnmower gearing. Accuracies are such that even door locks are now made of powder metal.

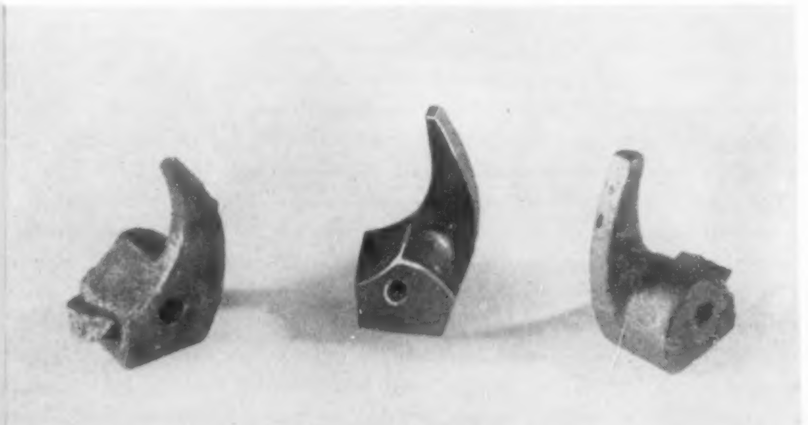
The usual tolerance for powder metal parts with major dimensions up to two inches is 0.001 inch per inch radially, and 0.005 inch in the direction of pressing. In special cases these tolerances can be decreased. Porosity can be controlled to a certain extent and the density range, compared to a conventional casting, can be from 96 to 80 percent, or lower.

From this data it may be surmised that powder metal parts compare favorably with fully automatic screw machine parts in similarity of shapes and volume needed to amortize the die or setup time. On the other hand investment castings may be compared with respect to production volumn, to small parts machined with manual control. The shapes made by investment casting, however, can be much more intricate.

INVESTMENT CASTING VS. PLASTER CASTING: Relatively simple shapes of aluminum and brass alloys can usually be made better and more economically by the plaster of Paris molding process than by investment casting, especially where production is in small quantity. Plaster molded parts are smoother.

INVESTMENT CASTING VS. SHELL MOLDING: Di-

Fig. 2. Typical small investment cast part (center) for electronic equipment is brass. It is ¼-inch long with a 1/16-inch diameter hole. Formerly used sand cast parts are shown at right and left prior to machining. Savings in production costs of 60 percent were secured by the changeover.



nsional tolerances, surface smoothness and riety of metals that can be cast are practically ntical in both processes. In simpler shapes and rger sizes shell moldings may result in more economical parts. The shell molding process, however, is not been in use long enough to ascertain the full tent of its possibilities. Present indications are at it will widen the scope of application of precision castings.

bosses, *Fig.* 3, can be investment cast more economically than by other methods.

Within the restrictive range of sizes discussed later, openings and holes of almost any conceivable shape may be incorporated in investment castings. A single opening could be partly cylindrical, partly square and partly irregular. One portion of this same opening could be countersunk while the rest was chamfered. Rings with accurately placed lugs

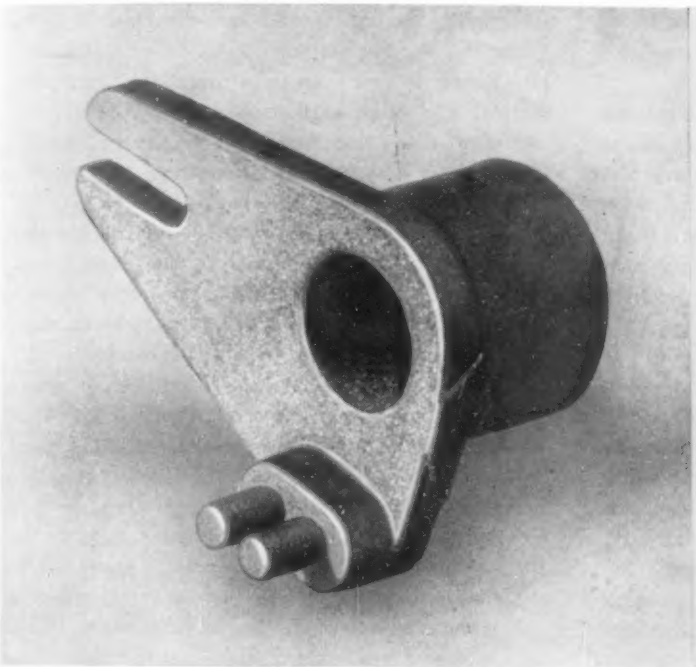


Fig. 3. Investment cast in brass, this crank would have been difficult and expensive to machine because of its small size—average height is 0.375 inch. Studs are cast integral with the piece and tolerance of the slot is held to 0.002 inch.

Field for Investment Castings: When ferrous parts are considered, investment casting offers the possibility for more intricate exterior and interior surfaces than could be economically produced by any other method. The same is true of nonferrous parts in modest quantities. Thinner cross-sections can be obtained by investment casting than by other methods, especially in ferrous parts. Such cross-sections may be reinforced by incorporating ribs or other structural details. These may be cast in to minimize warpage that might result from welding, brazing, heat treating or other subsequent operations. Curved sections may also be incorporated for the same purpose. Otherwise unobtainable chambers with tortuous turnings and variable cross-sections can be produced in the wide range of investment casting alloys.

An example of such a chamber is an internal oil reservoir with oil feed channels that is produced at less cost than would be possible by other metalworking methods. It is also possible to incorporate brazing metal reservoirs when the investment cast part forms a portion of an assembly. Similarly intricate are easily cast. Gears and cams of alloys too tough for economical machining or hobbing can be produced by investment casting, as well as cams with side teeth or contours and gears with side grooves or contours. The ideal use of investment casting is for small parts requiring accuracy with little or no machining and for runs in modest quantities. The process is especially adaptable for use on tough metals and complex designs.

Design and Production Considerations: The maximum lengths and widths of parts that can be produced by investment casting are presently about 5 x 8 inches. Minimum cross-sections vary from 0.035 to 0.050 inch. A 12-sq in. area may be as thin as 0.040 inch. The ideal competitive weight range for investment casting is from one ounce to one pound, though parts up to about 15 lb in weight are regularly made. Flatness is usually maintained with ribbed supports.

Tolerances of castings can be held between 0.005 and 0.004 inch. On sections under ½ inch in length, tolerances can be maintained between 0.003 inch and

0.002 inch. The minimum tolerance allowed for gated areas, however, is 0.010 inch. An edge radius of 0.005 inch is required at fine pitch crest serrations. The as-cast surface smoothness varies from 70 to 120 microinches under normal conditions.

Fillets are advantageous both functionally and in producing a stronger pattern. Minimum fillet radius should be 0.015 inch and whenever possible, $\frac{1}{16}$ to $\frac{1}{8}$-inch radii are preferable.

Although draft is not required in precision investment casting, easier withdrawal occurs if a $\frac{1}{2}$-degree draft is maintained, especially with some shapes and alloys. Machining allowances should be from 0.010 inch on small sections to 0.040 inch on large sections.

Minimum core diameters on difficult alloys are about 0.040 inch, although for more castable alloys they can be 0.020 inch. Even finer cores may be used at extra cost. The diameter of holes should be no less than one half the section thickness. Blind holes should be avoided but where necessary they should not exceed a depth of over twice the hole diameter.

Cast threads seldom exceed a Class 1 fit, and it is usually more economical to cut or grind threads than cast them. The exception is for nonmachinable alloy thread sections. External threads that are smaller than $\frac{1}{4}$ inch with a pitch finer than 20 for ferrous and 14 to 16 for nonferrous alloys are seldom feasible. Threads longer than $\frac{1}{2}$ inch must have pattern pitch compensated for shrinkage.

Physical properties of as-cast parts are equal to the mean between the longitudinal and transverse values for rolled bars, i.e., the ultimate strength is less than that of a wrought bar longitudinally, but greater than that of the wrought bar transversely. Similar relations exist with respect to comparisons of yield strength and other physical properties.

Nonheat treatable and heat treatable alloys may be investment cast. With the latter it is generally better to anneal prior to machining operations. Some alloys are more castable than others which, of course, is reflected in costs. For example, 85-5-5-5 brass is easily cast, and to a lesser degree so are other brasses with the exception of leaded brasses. Beryllium copper, manganese bronze, phosphor bronze and silica brass can all be cast. Aluminum alloys can also be cast if no copper, zinc or magnesium is present. All straight carbon steels are inferior to equivalent grades of low alloy steels and in spite of slightly higher metal costs, the final price per piece is less. Similarly low carbon chromium steels are harder to cast than the straight 18-8 type alloy. Stellite and other high temperature, high abrasion resistant alloys are regularly investment cast. Indeed, some shapes lend themselves to no other method of precision forming.

Drawings for parts to be made by any precision casting or molding method should be several times actual size in order to show detail or, as an alternate a photograph of an actual piece could be enlarged. Dimensions should be shown for the machined part; not as-cast, unless machining or grinding is not required. Surfaces that require holding of tolerances should be indicated with placement of parting lines.

Summary: Investment casting may be considered as a forming tool that shapes parts so that little or no machining is subsequently required. By the elimination of heavy-cutting or metal-removing operations investment casting reduces the workload on tools and machines. Wider use of investment casting will enable machine shops to produce more work per dollar invested per available skilled worker, resulting in lower overhead and lower end product costs.

Bright Outlook for Carbides

CURRENT TRENDS appear to forecast a big year ahead for cemented carbides. The two major elements involved in this optimism are the present rapid developments of automated machines and the obsolete state of equipment in a large number of small and medium-size metalworking manufacturing plants.

These factors were discussed recently by Kenneth R. Beardslee, general manager of Carboloy Dept. of General Electric Co. His points are that, in the main, companies have been quite impressed with automated production lines, such as those used in various automotive plants, and many of the larger firms have incorporated similar machinery. And these units, with their high speeds and heavy cuts, demand a particularly tough cutting tool. Cemented carbides, since they meet these requirements successfully, obviously face a happy future.

Now, too, he points out, small and medium size companies are facing the necessity of retooling since they are operating with equipment which may well have passed into the obsolescent category sometime back. In view of the metalworking trend, they will necessarily replace it with machinery with enough speed to meet competition or go out of business. Perhaps their machinery will not be of the automated level of larger production lines, but its requirements will undoubtedly be similar. Logically then, use of the strong cemented carbides will enjoy a comparable increase in demand.

Finishes for Metals

Inorganic and Protective Coatings

By Robert A. Wason
Associate Editor

MOST METALS are formed and fabricated easily, possess structural strength, are tough and long lasting—but they are subject to corrosion. This one limitation, common to all metals in varying degrees, is responsible for damage to equipment amounting to hundreds of millions of dollars annually. Finishes for metals are primarily designed to prevent, or at least control, corrosion. A secondary reason for coating metals is the eye appeal that such coatings impart to completed products, *Fig.* 1. This second reason is becoming increasingly important, but with no sacrifice of corrosion protective properties, as industry and the public are becoming more conscious of color and its uses.

Finishes for metals should be chosen only after complete performance specifications are set up. Conditions of use are important to the life and performance of a finish. Not only is the metal important, but the ambient conditions of temperature, humidity, abrasion, fumes, etc., must be considered. The correct finish is usually specified after a number of compromises have been made among properties desired, expense of finishing materials, cost of application and service life desired.

Finishes and coatings are therefore frequently chosen by a process of elimination. Each condition of use of the product will prohibit use of various families of finishes. If production is to be large, it is well worth the effort of contacting a finish manufacturer. Based on past experience, the manufacturer can eliminate unuseable finishes more quickly and can concentrate on modifying the type that most nearly meets performance requirements.

Whether a finish is to be selected by the product manufacturer or the finish manufacturer, the questions in *Fig.* 2 should be assigned priorities and answers should be found for them, in order to determine the best finish for the application. Detailed studies of the classes of finishes will show how various groups must be disqualified depending on the particular requirements of the product in use.

Conversion Coatings

There is a variety of chemical surface treatments in which the metal surface is converted to a corrosion-resistant film. Most of these are not durable and are used primarily to increase the bond between the metal and an organic finish. Briefly, these coatings provide "tooth" for anchoring coatings, are good retainers for wax and oil rust preventives, and prevent undercutting of organic films if they are ruptured.

The phosphate class of conversion coatings was discussed in Part 1, "Cleaning and Surface Preparation," THE TOOL ENGINEER, November 1953, be-

cause such coatings are more closely associated with cleaning and surface preparation. These coatings are not usually durable and are either treated with rust preventives or covered with organic finishes.

Oxide conversion coatings can be formed on a variety of metals by simple dipping in hot (200-300 F) chemical solutions. Pentrate Super Black, for example, produces a jet black ferrous ferric oxide coating on iron or steel. The coating is integral with the metal surface and will not crack, chip or peel. Parts can be formed after blackening, and the oxide layer does not alter the dimensions of the part. This particular coating withstands continuous exposure to 650 F temperatures and samples have been heated to 1000 F without flaking. It can be applied to hardened, cyanided, carburized or surface hardened parts. The coating reduces friction (it is frequently applied to cutting tools for this purpose), can be used on brazed assemblies and does not interfere with subsequent spot welding.

Various types of proprietary solutions are available for blackening low and medium carbon steels, stainless steels, cast and malleable iron, copper, brass, zinc castings and plates, and cadmium. These blackening solutions should all be used with caution. Salts should not be handled by bare hands and bath operators should wear goggles, protective gloves and aprons, *Fig.* 3. The bath should be ventilated.

An interesting application of a copper blackening process illustrates the high light and heat absorbing properties of black oxide coatings. The case of an electric motor was copper plated and then blackened. The specially finished motor operated 12 deg F cooler than a similar motor with a black enamel case.

A good blackening solution should be self-rectifying. It should contain a rectifying agent that will inhibit build-up of red colloidal oxide in the solution and counteract contaminants such as copper, zinc and aluminum. A small percentage of copper in the bath, for example, can plate out on the part. The copper coat so formed on steel can be removed only by a cyanide dip.

Chromate solutions are also used to form oxide coatings on metals. The patented Armco Blackening Process uses a bath of molten dichromates (usually sodium dichromate) at a temperature of about 750 F to form a black oxide coating on chromium-nickel and straight chromium stainless steels. The process requires about one half hour but the coating is more durable than those produced by some of the quicker processes.

Unichrome Dips use chromate solutions to form conversion coatings on zinc and cadmium. The coatings vary in color from clear (to simulate chromium), iridescent yellow, brass and olive drab to black, depending on the metal and bath compositions. These coatings are produced in from 5 seconds to 2 minutes at room or slightly elevated temperatures.

Most chemical finishes add nothing to the surface of aluminum to improve resistance to corrosion or abrasion. Adherent oxide coatings (best results are obtained by electrochemical methods) are an exception to this generality. Such coatings improve resistance to both corrosion and abrasion, and can be dyed with a wide range of colors.

Rust Preventives

Rust preventives or preservatives are coatings applied to finished or partially finished products to protect them during storage or transport. Be-

Fig. 1. A well finished product, whether it be a Norton grinder or a consumer appliance, pleases the eye and inspires confidence in the user, as well as prolonging the life of the product.

cause they are easier to remove than plate, enamel or oxide coatings, preventives are frequently called temporary. Some preservatives, however, have longer rust preventive lives than many so-called permanent coatings. Much basic information has been learned about preventives by the various military organizations charged with the responsibility of maintaining military materiel ready for use with a minimum drain on public funds.

Straight mineral oils are not considered satisfactory preservatives by themselves. Oils and greases shield metals from air but have no water-displacing properties. Corrosion is an electrolytic action involving the presence of air and moisture. A proper rust preventive breaks the electrolytic circuit by removing moisture or forming a barrier between it and the metal.

Most rust preventives contain surface active minerals or inhibitors. These additives are used in mineral oil or grease bodies. They "wet" the surface of the metal and cling to it by adsorption. Preservative wetting and adhesive forces are greater than those of water and other corrosive agents.

Some preservative additives are called polar compounds because one portion of their molecules has a strong affinity for metal and the other portion repels water. Solvent types of polar preventives can be used for indoor or shed storage and form soft, durable films, *Fig.* 4. They displace moisture on application and can be used on parts already exposed to humidity. The U. S. Navy program of keeping ships in reserve at a high state of readiness makes use of large quantities of thin-film polar type compounds. Solvents for these are of a light kerosene type that evaporates. The film is formed by solids, semisolids or wax-like inert materials. They are easy to remove, have long lives and can be used on any metal subject to corrosion. Various grades are used for outdoor exposure, below-deck exposure and machinery interiors.

Factors in Finish Selection

1. What material is to be finished?....................................
2. Is finish primarily for protection or appearance?......................
3. How is coating to be applied?
   brush...... spray...... dip...... flow......
4. Is drying time important?..
5. What facilities are available for force-drying the applied finish?........
   ....
6. What is reasonable service life desired of finish?......................
7. Which of the following properties are most important in the finish?
   adhesion...... flexibility...... gloss......
   hardness...... toughness...... color......
8. Will finished product be in constant or occasional contact with corrosives?
   fumes...... liquids...... solids......
9. To what degree must the coating resist:

foods.....	cigarette burns....	abrasion......	alkalies......
acids.....	discoloration......	alcohol.....	chalking.....
heat......	fruit juices......	marring......	chipping.....
soap......	outdoor exposure...	mineral oil.....	gasoline.....
wear......	perspiration......	sulphides......	humidity.....
water.....	vegetable oil......	salt spray.....	sunlight.....

Fig. 2. A product manufacturer or a finishes expert should have weighted answers to all these questions before specifying a finishing system.

Grease type preventives range from soft, greasy or petrolatum types to heavy, hard wax-like compounds, *Fig.* 5. They are hard to remove. Most oil types do not dry or set and achieve their final film thickness and consistency only by draining. In general, solvent types yield films that are thin, hard and difficult to remove. Asphaltic resin solvent types are similar in appearance to paint or varnish and they resist abrasion. Water soluble emulsified grease preventives can be diluted to give just the required life to the film. The water evaporates and leaves a nonporous greasy film.

A special type of preventive is used on and around electrical components. Called Rust Veto 110-D, it forms a dry, nonremovable film 0.002 inch thick that resists water, gasoline, heat, exposure

—Photo courtesy E. F. Houghton & Co.

Fig. 3. Small tools can be contained in a wire mesh basket and soaked in a chemical blackening solution to form a jet black protective oxide finish.

and salt water. It is flexible and adhesive but neither affects the life of rubber nor reduces dielectric strength or heat conductivity. It is a clear, nontoxic synthetic resin varnish.

Rust preventives are selected after determining the storage or shipping conditions, the degree of protection desired, the ease of removability required and the method of application (cold or hot dip, spray, slush or brush). In addition, the composition, surface characteristic and construction of the product must be considered. A good general rule is that the more intricate and delicate the assembly, the lighter should be the grade of the rust preventive.

Strippable Plastic Coatings: This family of coatings has the same uses as mineral oil rust preventives but presents a different solution for the problem. Coatings of peelable plastics are most frequently applied to metallic parts with plain continuous surfaces, although newer formulations can be applied to almost all types of components. Being tough, elastic and impermeable, peelable coatings protect against mechanical damage as well as corrosion. For this reason, much coatings are frequently used to package new drills and other cutting tools, and to protect resharpened tools between the toolroom and the point of use.

These coatings can be used for masking during conventional organic finishing operations. The coatings are usually transparent, so that surface condition can be visually checked, but can be tinted to insure application of a full coat when it is sprayed on. Peelable coatings have the ability to adhere tightly to metals but also must possess qualities to allow them to be stripped. By using formulations with tensile strengths from 300 to 3000 psi no difficulties are encountered during removal.

Solvent types of peelable coatings are based on vinyl polymers and cellulose acetate butyrates carried in volatile solvents. They will attack most air-dry finishes but can be used over high-temperature baked and vitreous enamels. Butyrate-base coatings are more resistant to abrasion, less adhesive and have slightly lower tensile strength than vinyl polymers.

Water dispersion coatings are compounded, plasticized synthetic resins in water. The film dries by natural evaporation but drying can be accelerated by forced air or infrared heat. Many different resins are used this way and each gives a coating with different properties. For example, a polystyrene latex base water dispersion produces a film with strength intermediate between butyrate and vinyl solvent type coatings. Other films have strengths up to five times as great as vinyl ploymer films. In spray or when dried, water dispersions are nonflammable, but styrenes and vinyl butyrates used with certain plasticizers produce films that will support combustion.

Hot melt peelable coatings are supplied in briquette form for melting as required. After stripping, many of these coats can be melted and reused. Bases for hot melts are ethyl cellulose and cellulose acetate butyrate. Ethyl cellulose types require higher dipping temperatures that must be critically controlled to prevent discoloration. Film strengths of this class are similar to solvent types with butyrates having slightly lower strengths. Butyrate coatings, however, have greater flexibility. Both types can be formulated to exude corrosion inhibiting oils.

Solvent and water dispersion classes of strippable coatings are much used to protect finished, bare metal surfaces during forming and fabricating steps. Hot melt types are most used for packaging. Some of the hot melt coatings are applied to permanently protect metal surfaces.

Plastisols (fluid dispersions of vinyl resins in plasticizers to which stabilizers, corrosion inhibitors, colors and fillers are added) can also be used to protect metal parts against corrosion in storage. This group of coatings will be described in more detail in Part 3 of this series, but is mentioned here because it offers the properties of hot melt strippable coatings with additional advantage of application at ambient temperatures.

Although applied at room temperature, plastisol coatings must be cured at temperatures of 300 F, so they are restricted to parts that will not be damaged by such elevated temperatures. The main gain of plastisols over hot melt coatings is that temperatures are not so critical. Overheating of hot melt coatings in the dipping pot can cause deterioration of the plastic base and consequent loss of film strength.

Inorganic Coatings

Organic finishes have limitations that cannot be overcome by altering formulations or by shifting from one type to another. For this reason, the time-honored fused enamels have come into modern prominence. These mineral oxide enamels fused to metals are often called "porcelain" enamels but, since they are not porcelain, they are properly termed "vitreous" enamels.

Primary reasons for using vitreous enamels are their long coating life, high resistance to corrosion and resistance to high temperatures. For many years they have been applied to food handling equipment in the home and in industry. In recent years, high-temperature baking enamels (organic) have supplanted vitreous enamels on home appliances. The vitreous coatings have moved on to even more important fields.

As ceramic coatings, *Fig.* 6, these metal finishes are permitting increases in operating temperatures in various branches of industry. They are being increasingly used on aircraft and ground ordnance. In high-temperature corrosive gas applications, ceramics are saving critical metals, extending service lives of critical alloys that must be used and enabling substitution of less critical metals. Ceramic coatings can frequently save weight because metal

—Official Photograph, U.S. Army Ordnance Dept.

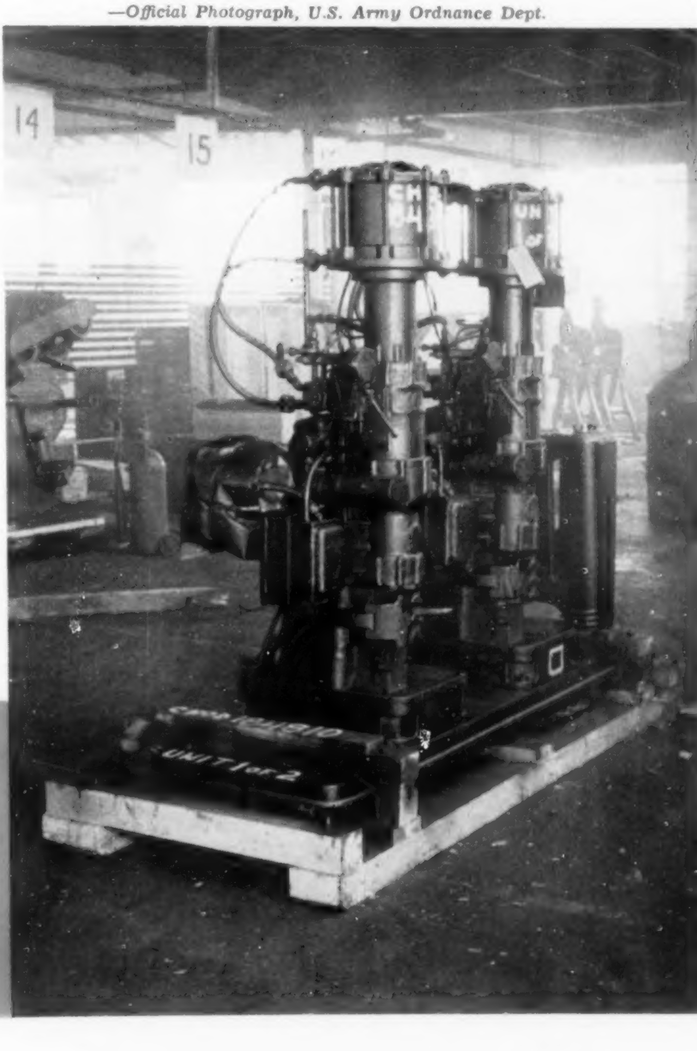


Fig. 4. Machine tool skidded and stored for future use is protected by several rust preventives. The liquid carrying system has been run under power and treated with an oil engine preservative. Finished metal surfaces are treated with a nondrying medium hard grease and oversprayed with a thin-film hard-drying solvent solution of the polar type. Painted surfaces are coated with the latter compound.

gages can be reduced and still result in a part with an equivalent or better life.

Vitreous enamels have been used in exhaust manifolds and pipes of luxury automobiles to resist the corrosive effects of hot exhaust gases and to lower back pressure because of the smooth surfaces formed. Vitreous enamels can be formed with gloss, mat or semimat finishes.

Former vitreous enamels had to be applied on special enameling iron or good grades of drawing steel with carbon contents of less than 0.20 percent. Ordinary steel could not be used because impurities caused blistering and chipping of the coat.

Advances in vitreous coatings have greatly increased the types of materials that can be enameled. In many instances ground coats are no longer necessary. However, better results can still be achieved with combinations of special enameling materials.

Any material that is to be enameled must resist sagging and warping at firing temperatures. Freedom from impurities increases resistance to these faults. Also, the newer metals can be fired at substantially lower temperatures. This is not true of the newer ceramics, firing temperatures for which are higher than former temperatures for vitreous enamels.

Refractories and fluxes are smelted and then shattered to form the frit. Ground frit is mixed with clay and water to form a slurry, called slip. Metal oxides are added to the slip to give the desired color. Parts are dipped in the slip, or it is sprayed or slushed on the part. A high temperature firing dries the coating and fuses it.

Because the color oxides are mineral, vitreous enamel colors are far more durable than those obtained with organic finishes. If absolute color permanency is desired, a thin, clear covercoat of an acid-resisting vitreous enamel should be used. Without the acid resistant coat, light yellows and reds tend to fade. These same colors are also difficult to match. Cadmium and iron compounds produce red, chromates give green and cobalt gives blue.

Vitreous enamels are formulated so they have the same coefficients of expansion as the metals on which they are fused. Properly matched metals and vitreous enamel coatings are unaffected by rapid temperature changes. These coatings also have the ability to absorb radiant heat energy without bad effects.

There are three basic types of vitreous enamels containing (1) antimony, (2) zirconium or (3) titanium as the characteristic material. Opacity of

Fig. 5. A heavy bodied grease type rust preventive is brushed on working parts of a locomotive prior to shipping it to India on the open deck of a ship.

—Photo courtesy E. F. Houghton & Co.

—Photo courtesy Bettinger Corp.

Fig. 6. High temperature ceramic coatings are put on after many preliminary steps as shown by these ten rows of jet aircraft engine nozzle boxes. Each row shows at least one step (from the left): (1) as received, (2) pickled and annealed, (3 and 4) repickled, (5) flash fired, (6) sand blasted, (7) coated inside and dried, (8) inside spill brushed from outside, (9) completely coated and dried, and (10) fired.

these three families increases in the order named. The titanium type is acid resisting, has good coverage, and good scratch and abrasion resistance in one thin coat. With antimony and zirconium, a second coat of acid resisting enamel must be used if such resistance is required. Zirconium enamels are not as scratch or abrasion resistant as the antimony types, and are more subject to corrosion.

Generally, decreased thickness of coating means increased ability to withstand abuse. Since titanium can be applied thinner for equal opacity, titanium enamels should be considered where abuse is expected. Too often, thermal and mechanical shock resistances must suffer to achieve the coating thickness for desired corrosion resistance.

For steels with small amounts of titanium, enamels containing titanium oxide will adhere well and ground coats are unnecessary. Omission of a ground coat makes the total finish thickness less and increases flexibility and impact resistance.

The composition of an acid resisting enamel primarily differs from ordinary enamels in its silica content. Silica content is usually 15 to 20 percent greater in acid resisting types. Acid resisting types also have smaller amounts of flourine compounds and boric acid.

Abrasion resistant enamels are more dense than ordinary types. They have a higher silica content and are fired longer. The gain of abrasion resistance is not made without compensating penalties. Longer firing times reduce shock resistance, opacity and adherence.

Vitreous Enamels for Aluminum: A new family of vitreous enamels has been developed for firing at temperatures between 970 and 1000 F. These can be applied in white and a wide variety of colors to wrought 61S, 2S and 3S; extruded 53S, 62S and 63S, and cast 43 aluminum alloys. Alloys containing significant amounts of copper or magnesium, such as 24S, 17S and 52S cannot be used successfully. Scrap alloy, 113, should never be used.

Alloy tempers make no difference when coating with vitreous enamels, and enameled parts can be treated by conventional methods to restore temper after firing. Metal stock should be carefully cleaned but should not be anodized or treated with strong cleaners or corrosion inhibitors. All alloys, except commercially pure 2S and 3S, must be given a pretreatment in a hot solution of chromate and caustic. Prefiring, at regular firing temperatures, is done after pretreatment to render the chromate salts insoluble so they can't bleed and discolor the enamel.

Compositions of ground coats are varied to meet requirements of the particular alloy and to provide a base coat of the correct color and covering characteristic for white or colored covercoats. Standard clear groundcoats are preferred except when a white or pastel covercoat is used. Satisfactory results can be achieved with a colored covercoat over white. Covercoat compositions depend on color desired, alloy used and resistance required.

Combinations of color, stipples, ripples and multicolor mottles can be obtained easily. Surface texture can be varied by forming the aluminum and light reflectance can range from gloss to dull mat. Reduction in gloss is obtained by increasing the amount of titanium dioxide in the covercoat. Mat

and semimat finishes can only be applied over a groundcoat because they do not form a satisfactory bond with the metal.

Exposure to strong detergents causes no staining, streaking or loss of color. These enamels can withstand attack of acids, alkalis and sulphides as well as vitreous enamel coatings on steel. Aluminum enamels are relatively unaffected by salt water.

Vitreous enamel coatings on aluminum average 0.004 inch in thickness but can be controlled between 0.001 and 0.007 inch. Thinner coatings withstand thermal shock better; thicker coats are more resistant to scratching and mechanical damage.

Enameled panels have been heated to 1000 F and plunged into cold water without flaking or cracking the enamel. Enameled panels can be sheared; cut by abrasion, band or hack saws; and drilled or punched with little damage to the enameled surface and without subsequent spalling. Limited forming can be accomplished on fired enameled parts. Welding can be done prior to firing and enameled sheets can be butt welded from the back without damage to the enamel surface or color.

Vitreous enamel coatings can be applied easily to parts that have been designed for enameling. Generous radii are necessary to insure covering of corners during spraying of the slip. Castings should have sections as uniform as possible to prevent warpage at firing temperatures. Permanent mold castings are most free of porosity and give best enameled surface of all casting types. Sand casting quality is not always adequate for enameling and the enameling of die castings is not presently recommended.

A standard thickness coating of vitreous enamel increase rigidity of aluminum sheet up to 60 percent. Because of this increased rigidity, lighter gages can be used in many applications with consequent metal and weight savings.

At the present time, all aluminum enamels have a high lead content and for this reason no current enamels should be used on aluminum surfaces that are to come into contact with food.

(To be continued)

Acknowledgements

The helpful cooperation of the following companies in supplying information for this article is gratefully acknowledged:

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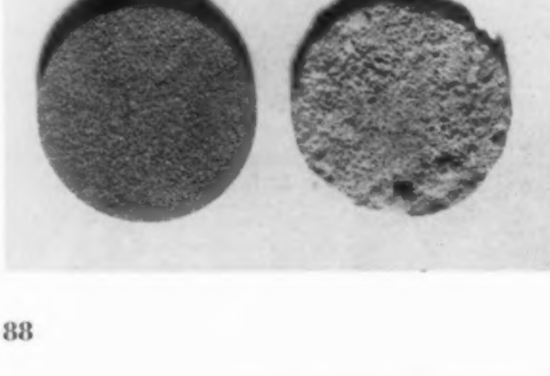
Dept. of The Navy, Bureau of Ships	**Washington, D.C.**
E. F. Houghton & Co.	**Philadelphia, Pa.**
E. I. Dupont de Nemours & Co.	**Wilmington, Del.**
Fidelity Chemical Products Corp.	**Newark, N.J.**
Heatbath Corp.	**Springfield, Mass.**
National Bureau of Standards	**Washington, D.C.**
Pemco Corp.	**Baltimore, Md.**
United Chromium Inc.	**New York, N.Y.**

Porous Castings Mechanically Impregnated

Porous castings can be economically sealed by a new process and with equipment developed by American Metaseal Mfg. Corp., New York, N.Y. Heart of the system is a solventless polyster resin impregnant that flows into the pores under vacuum and pressure. The monomer is heat polymerized into a hard, infusible material without loss of volume.



Castings are cleaned and processed in batches. Equipment is grouped around a power hoist so no manual lifting operations are required. Major units are two wash tanks, a high vacuum pump, a mechnical surging tank and two autoclaves. Parts are lowered into the autoclave for the vacuum-pressure impregnating cycle.

Excess resin is removed from surfaces by emulsifying cleaners but resin is not removed from the pores. The material is stable with all alloys and its polymerization is not inhibited by any metal. In addition to sealing castings from inside leakage, the surface produced by this process provides corrosion resistance and is a good bonding agent.

Illustrating the penetration of Metaseal 19V5 into cast metals, the disk at left is an impregnated casting. At the right, a similar disk is shown after immersion in 50 percent nitric acid. The metal was completely dissolved but the resin was not damaged.

Tolerance Conversion Chart

By **Allen Johnson***
President, Oak Knoll Engineering Service, Springfield, Mass.

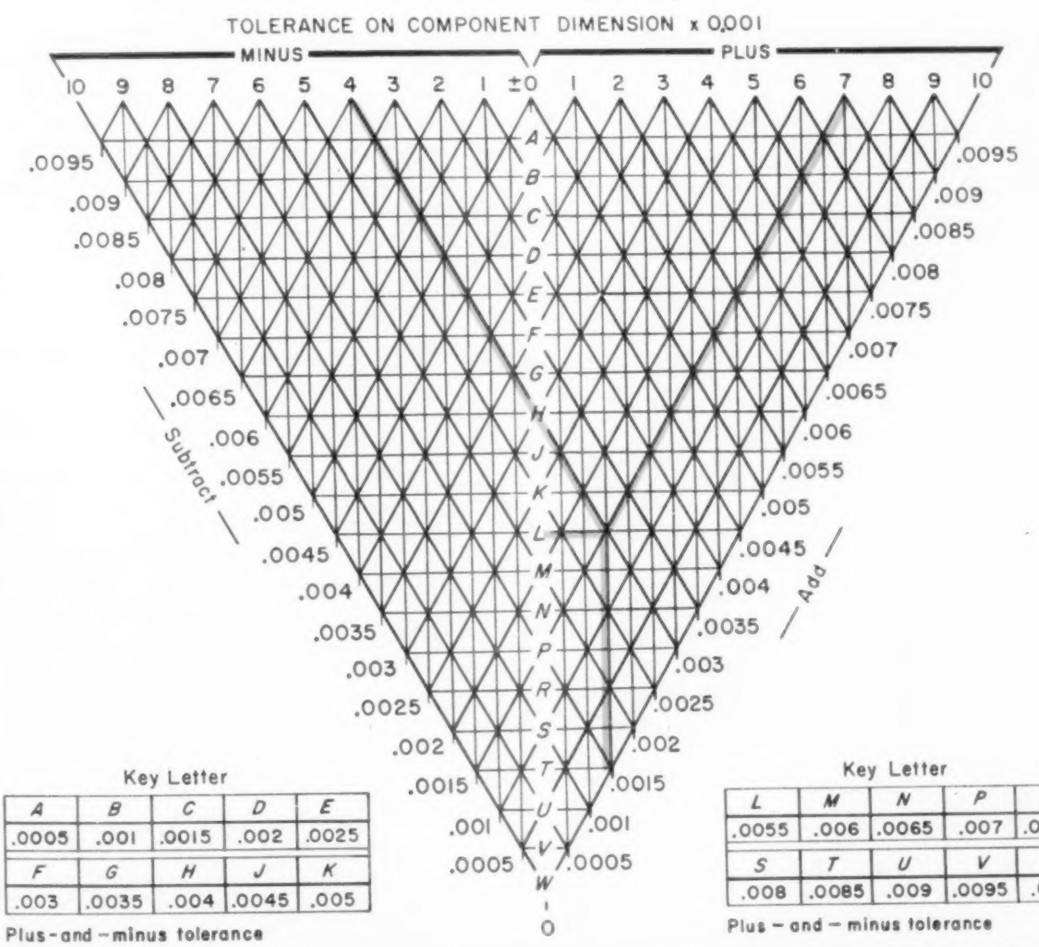
SINCE IT IS EASIEST to calculate cumulative tolerances from dimensions having equal bilateral tolerances, this chart has been prepared to speed the conversion of dimensions having unilateral or unequal bilateral tolerances.

The chart is entered from the top at the plus and minus or the unilateral and zero tolerance points. Diagonal lines are followed from the correct pair of points until they cross. Vertically below this point of intersection is a value that must be added to or subtracted from the basic dimension so it can take an equal bilateral tolerance and still retain the initial limits. Horizontally opposite the intersection point is a key letter. From the tables of key letters, the value of the equal bilateral tolerance is found.

EXAMPLE: Convert the dimension 5.000 with unequal bilateral tolerances of plus 0.007 and minus 0.004 to a dimension with an equal bilateral tolerance.

SOLUTION: From plus 0.007 follow the diagonal to its intersection with the diagonal from minus 0.004. The value 0.0015 is added to the basic dimension. The key letter, *L*, indicates an equal bilateral tolerance of 0.0055. The new dimension is: 5.0015 ± 0.0055.

*Senior member ASTE Springfield Chapter.



Key Letter

A	B	C	D	E
.0005	.001	.0015	.002	.0025
F	G	H	J	K
.003	.0035	.004	.0045	.005

Plus-and-minus tolerance

Key Letter

L	M	N	P	R
.0055	.006	.0065	.007	.0075
S	T	U	V	W
.008	.0085	.009	.0095	.010

Plus-and-minus tolerance

Graphical Determination of Blank Diameters For Drawn Cylindrical Shells

FOR SINGLE-ACTION DRAWS, reasonable approximations of blank diameters can be calculated from the finished shell dimensions if the shells have moderate corner radii. Formula for the blank diameter is:

$$D = \sqrt{d^2 + 4dh}$$

where D = Blank diameter, inches
d = Shell diameter, inches
h = Shell height, inches

Relationships between these physical dimensions are shown in *Fig.* 1.

With the same conditions, blank diameters can be determined graphically to the same degree of accuracy. A perpendicular is erected on a horizontal base line, *Fig.* 2. The height of the shell is marked off on the perpendicular. With $h + 1/2d$ as a radius and the top of the measured perpendicular as the center, an arc is scribed to cut the base line in two places. The distance between the two marks equals the diameter of the blank that would be required to produce the shell. For Maximum accuracy, the drawing should be full size, and for small shells, should be larger than full size.

That this graphical method is correct can be easily proved. Since the area of the blank must equal the area of the shell, *Fig.* 1, then:

$$\frac{\pi D^2}{4} = \frac{\pi d^2}{4} + \pi dh$$

$$D^2 = d^2 + 4dh$$

$$D = \sqrt{d^2 + 4dh}$$

From *Fig.* 2 it can be seen that x must equal $1/2d$, if the method is correct, so that:

$$x = \tfrac{1}{2}\sqrt{d^2 + 4dh}$$

then

$$x^2 = \frac{d^2}{4} + dh$$

$$x^2 + h^2 = \frac{d^2}{4} + dh + h^2$$

$$x^2 + h^2 = (h + 1/2\mathrm{d})^2$$

Since x and h are legs of a right triangle, the sum of their squares must equal the square of the hypotenuse. Since all values are thus related correctly, $h + 1/2d$ is the correct radius for the graphical construction.

Fig. 1. Comparison of shell dimensions to blank dimension.

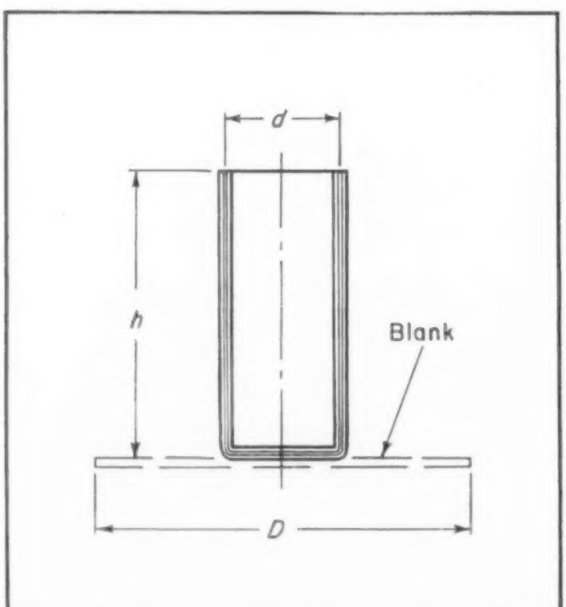
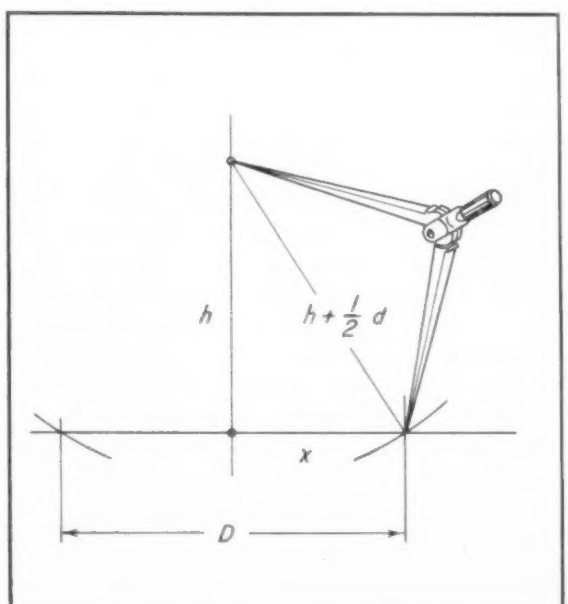


Fig. 2. Method of determining blank diameter by graphical construction.



ASTE

news

featured this month

22nd Annual Meeting

Tooling and Production Conferences to Reveal Modern Practices

By Nancy L. Morgan

Sharing honors with 450 exhibits as a top attraction at ASTE's Industrial Exposition and Annual Meeting in Philadelphia next April 26-30 will be a five-day schedule of technical programs. An entire day has been designated to emphasize each of the following five subjects: plant management, automation, cutting and grinding, precision control, forming and assembly.

In addition to lectures presented by 50 outstanding speakers, daily panel discussions will provide ample opportunity for ASTE audiences to receive what, in effect, will be expert consulting engineering counsel.

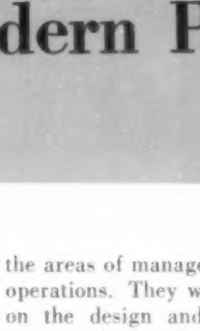
During these conferences 35 men representing machine and tool manufacturers, plant operating management, and government agencies wherever concerned, will share their wide and varied experience. With this balance of viewpoints on each panel, ASTE members are assured of getting specific answers for their manufacturing and production questions.

In order that the most pressing problems of the day may receive highest priority, the Society is urging members to submit all queries by April 1, so that each one may be referred well in advance of the Annual Meeting to the expert best qualified to answer it. Questions from the floor during the conferences will be answered only if time permits.

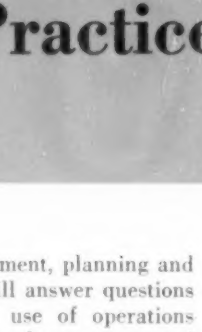
Awards of 15 *Tool Engineers Handbooks*, three for each of the five panels, will be made for the most interesting and timely questions. Discussion speakers will act as judges. All questions should be sent to ASTE National Headquarters, 10700 Puritan Ave., Detroit 38, Mich.

Production Planning

At the panel discussion scheduled for April 26, "Production Planning and Control" will be covered by experts in the areas of management, planning and operations. They will answer questions on the design and use of operations process sheets, flow charts, operators' instruction sheets, machine loading



Kitzman



Murphy

Perris

Tann

Verkler

Weaver

schedules, and scheduling, routing, and dispatching operations and paper work in large or small plants with high or low production. Participating will be the following men.

Emil Kitzman is now general superintendent of the newly-built Colmar, Pa., plant of the Link Belt Co. He was previously superintendent of the machine shops of Link Belt's Philadelphia plant and general superintendent of the company's Dallas plant, where he supervised the setting up of departments directly responsible to the manufacturing division.

Herbert Murphy is head of the planning department of Grumman Aircraft Engineering Corp., Bethpage, Long Island, N.Y. He joined the company in 1940 as a purchasing agent and the following year organized the planning department. Previously he was a statistician and analyst for 12 years for a Wall Street firm.

Norris M. Perris, a leading consulting engineer, is senior partner in the firm of Stevenson, Jordan & Harrison, Inc., New York, N.Y. He is a mechanical engineering graduate of Case Institute of Technology and holds a masters degree in economics from the University of Pennsylvania. Formerly a member of the board of directors and vice president of the Association of Consulting Management Engineers, Mr. Perris has had more than 35 years experience in the industrial engineering field. He has written several articles for The Tool Engineer and other leading industrial magazines.

Walter L. Tann is chief industrial planning engineer at the Bureau of Ordnance, Department of the Navy, Washington, D. C. He received his education at the Engineering School for Special Apprentices conducted by the American Locomotive Co. A licensed professional engineer, he has written and lectured extensively on production control and is co-author of the textbook *Production Control* and an editor of *Production Handbook*. During World War II he was on active duty as a captain in the United States Naval Reserve and served at the U. S. Naval Gun Factory and as officer-in-charge at the Plant Facilities Branch of the Bureau of Ordnance.

Charles E. Verkler is assistant manager of manufacturing at the Peoria, Ill., plant of Caterpillar Tractor Co. He joined the firm in 1936 after attending Bradley University in Peoria and worked up through the positions of foreman, general foreman, superintendent and production manager.

J. R. Weaver is manager of manufacturing and engineering at Westinghouse Electric Corp., Springfield, Mass. In the past 38 years with Westinghouse, he has served in many capacities. He has been director of equipment and director of quality control, and during World War II he managed two ordnance plants. Author of several articles published in industrial magazines, Mr. Weaver has also been vice president in charge of manufacturing at Baldwin-Lima-Hamilton Locomotive Corp.

Tooling for Automatics

When the panel on "Tooling for Automatics" meets on April 27, conference speakers will discuss problems and answer specific questions on production tooling for screw machines, turret lathes, single- and multiple-spindle automatics. The following men will participate.

John L. Anderson is chief tool estimator at Gisholt Machine Co., Madison, Wis. When he joined Gisholt at the age of 18, there were no formalized ap-

Anderson

Brozek

Kettler

prentice training programs, but he spent several years working in all of the various departments. He left the demonstration and service department in 1941 to begin work with engineering estimating and became chief tool estimator in 1950.

John S. Brozek is superintendent of the Tooling and Maintenance Division,

McArthur

Olson

Prohaska

Spence

Sargent & Co., New Haven, Conn. A mechanical engineering graduate of McKinley-Roosevelt Graduate College, he has a diversified background in production engineering, and manufacturing and tooling in arms and ammunition components, electronics, builders' hardware and tools. He is a lecturer on design problems and author of an article on "Correct Approach to Die Design" in The Tool Engineer.

E. L. Kettler is manager of subcontracting at Potter & Johnston Co., Pawtucket, R. I., a subsidiary of Pratt & Whitney Division, Niles Bement Pond Co. He was previously assistant to the vice president in charge of manufacturing at Clayton & Lambert Mfg. Co., Louisville, Ky., development engineer with Hartford Empire Co. in Connecticut, and a tool maker and service engineer at the Pratt & Whitney Division at West Hartford. A graduate of the University of Connecticut with a degree in engineering, Mr. Kettler is a registered professional engineer.

F. J. McArthur is chief tool engineer at Jones & Lamson Machine Co., Springfield, Vt. He has spent nearly 20 years with the company, 10 of them in his present position. He joined the firm as a tool engineer, was made general foreman in 1937, and named chief tool engineer in 1943. A past chairman of the Twin States chapter, he received his earlier experience at Kingsbury Machine Tool Co., Keene, N. H.

T. H. Olson is chief tool engineer at the Materials Handling Division of Yale & Town Mfg. Co., Philadelphia, Pa. A graduate of Pennsylvania State College, his tool engineering experience also includes positions as chief tool designer and chief tool engineer at the Brill Motor Co. in Philadelphia.

John Prohaska is vice president and general sales manager of the Cleveland Automatic Machine Co., Cincinnati, O. After serving his apprenticeship with the Peerless Motor Car Co. in Cleveland, he joined his present company as a tool maker. In the next 28 years he advanced through positions of tool room foreman, assistant superintendent, district sales manager and sales manager.

Willard Spence is sales director in charge of automatic screw machine sales at Brown & Sharpe Mfg. Co., Providence, R. I. After attending Rhode Island State College, he joined the company in 1926 as an apprentice draftsman and was later assigned to the engineering department. In 1934 he became associated with the patent department, was put in charge of that department in 1939, and was later appointed head of the automatic screw machine tool department. He is author of the section on single-spindle automatic screw machines in the *Tool Engineers Handbook*.

Improved Milling Practice

A group of internationally known specialists will set their own agenda for the "Clinic on Improved Milling Practice," the panel scheduled for April 28. They will discuss questions on equipment, tooling, and operational phases of milling—peripheral, face, contour, jig, pantographic, etc. Taking part in this conference will be the following men.

W. A. Coe is sales and field engineer with Nelco Tool Co., Inc., Manchester, Conn. He was formerly service engineer with the Carboloy Co., Detroit, Mich. During World War II he worked on all types of machine tool equipment at the Navy Yard, Portsmouth, N.H. He also received valuable experience at the American Iron and Machine Works Co., Oklahoma City, Okla.

Coe

Jesse Daugherty is consultant of Hypro products at Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., where he developed the special planer type miller for the aircraft industry now known as the Hypro Aircraft Skin Miller. A graduate of Ohio Mechanics

(Continued on next page)

(Continued from page 93)

Institute, he also studied mechanical engineering at the University of Cincinnati. He was process engineer, tool designer and machine designer at Cincinnati Planer Co. and was later appointed chief engineer, vice president in charge of engineering, and vice president and works manager for the firm. When Cincinnati Planer Co. was purchased by Giddings & Lewis, he became manager of Hypro engineering and was later appointed to his present position.

Daugherty

Frommelt

Kaiser

Krabacher

Roubik

Vickers

Horace Frommelt is staff consultant at Detroit Milling Cutter Co., Detroit, Mich. His broad engineering experience includes two years as head and director of the Milling Div., Kennametal, Inc., Latrobe, Pa.; seven years as director of research at Kearney and Trecker Corp., Milwaukee, Wis.; ten years as professor and head of the mechanical engineering department at Marquette University in Milwaukee; and seven years as assistant works manager at the Falk Corp., Milwaukee.

Karl B. Kaiser is assistant to the vice president in charge of engineering at Ingersoll Milling Machine Co., Rockford, Ill., where he is responsible for development and research, patents, cutter engineering, and customer service engineering. He joined Ingersoll in 1937 after receiving his mechanical engineering degree from the University of Michigan.

E. J. Krabacher is senior research engineer in charge of applied research on metal cutting grinding at Cincinnati Milling Machine Co., Cincinnati, O. He holds a mechanical engineering degree from the University of Cincinnati and during his undergraduate years was employed at Cincinnati Milling as a co-op student. Author and co-author of several articles in the field of metal cutting, he has spoken before numerous technical society groups.

J. R. Roubik has been engaged in metal cutting research at the Kearney & Trecker Corp., Milwaukee, Wis., since 1943 when he received his mechanical engineering degree from Marquette University in Milwaukee. He has taken postgraduate work at the University of Wisconsin and was a lecturer in mechanics at Marquette from 1946 to 1951. Mr. Roubik has written several articles on metal cutting for the technical and trade magazines.

T. G. Vickers has been master mechanic at Clark Equipment Co. at Jackson, Mich., since 1946 when he joined the firm's former Frost Gear and Forge Division. He is now associated with the Transmission Division. A graduate of General Motors institute at Flint, Mich., he majored in industrial engineering and was a co-op student at Cadillac Motor Car Co. Before joining the United States Naval Reserve in 1943, his experience at Cadillac included work in plant equipment and control, and final car quality control.

Inspection Ways and Means

Equipment, operation, and supervision are all represented in the panel of authorities taking part in the April 29 conference on "Inspection Ways and Means." Problems in control of quality, manual and automatic gaging, and nondestructive testing will be covered by the following speakers.

Philip G. Fishback is manufacturing engineer at the Accessories Div., Thompson Products, Inc., Cleveland, O. He was previously chief inspector and head of quality control and then production at the White Sewing Machine Corp., and quality control engineer at Graflex, Inc. Co-author of the course "Quality Control Through Precision Measurement" now being taught at the Rochester Institute of Technology, he has acted on various reviewing boards of technical texts and written a series of articles which have been published in THE TOOL ENGINEER.

Joseph Manuele is director of headquarters quality control at Westinghouse Electric Corp. A graduate of Massachusetts Institute of Technology where he majored in electrical engineering, Mr. Manuele joined Westinghouse in 1925 as an inspector of railway and railway equipment. He gained further experience inspecting radio apparatus, power induction regulators, network protectors, and switchboards. In 1930 he was assigned to the headquarters inspection office and in 1940 became director of quality control. He is a regular contributor to technical journals and has presented numerous papers before many professional societies.

Franklin Meyer, Jr., is chief engineer with the Instrument Gage Div., Taft-Peirce Mfg. Co., Woonsocket, R. I. His past affiliations include positions as: supervisor of tool and gage design and manufacture, Moore Products Co., Philadelphia, Pa.; director of war production training, Philadelphia Suburban District; and tool designer and tool, die and gage maker at Synthane Corp., Oaks, Pa. He is a graduate of Drexel School of Technology and took additional work in mechanical engineering at the University of Pennsylvania. Author of several technical articles, he has delivered lectures for a number of technical societies and engineering groups.

Fishback

Manuele

Meyer

F. B. Murphy is field manager of the Johnson Gage Co., Bloomfield, Conn. He was previously assistant to the chief inspector in charge of gaging at Hamilton Standard Div., United Aircraft Corp., and in charge of gaging, methods and all inspection engineering problems. He joined Hamilton in 1940 following his graduation from the Uni-

ve... of Pennsylvania with a degree in me...ical engineering.

S. D. **Nicolas** is chief inspector at M... Engineering, Inc., Indianapolis, Ind. He was formerly in charge of the ga... inspection laboratory at the U...d States Naval Gun Factory and


Murphy


Polidor


Nicolas


Stimson

spent 12 years in Washington, D.C. His earlier experience includes 14 years as a tool and die maker with various manufacturing firms.

Edward C. Polidor is vice president and director of research at Optical Gaging Products, Inc., Rochester, N.Y., successors to Engineers Specialties Division where he served as chief engineer. As a member of the Army reserve, he was assigned to the Army Ordnance Department during World War II and made chief of the Rochester Ordnance Gage Section. He received his earlier industrial experience at Eastman Kodak Co., Jones & Lamson Machine Co., and Fellows Gear Shaper Co. Mr. Polidor holds a bachelor of science degree in engineering from Norwich University, Northfield, Vt.

Glen H. Stimson is manager of sales and chief engineer of the Gage Sales Div., Greenfield Tap and Die Corp., Greenfield, Mass. Associated with the company for the past 30 years, he has held his present position since 1940. He received his engineering education at Northeastern University. He has given a number of lectures before technical societies.

Workholding Ways and Means

At the conference on "Workholding Ways and Means" scheduled for April 30, panel members will discuss fixtures, jigs, chucks, collets and the like—whether mechanically, pneumatically, hydraulically, magnetically or otherwise actuated. The following experts will participate.

Joseph J. Balciunas is chief engineer at the Skinner Chuck Co., New Britain, Conn. Since joining the firm 25 years ago after his graduation from high school, Mr. Balciunas worked in every phase of manufacturing, engineering and sales before being appointed to his present position. He has also taken eight years of extension work at Connecticut State College and Hillyer College.

L. R. Burger is sales manager for the Logansport Machine Co., Inc., Logansport, Ind. His broad industrial background covers 37 years of practical experience.

Ken Cole is chief designer at the N. A. Woodworth Co., Detroit, Mich., where he is in charge of the engineering department. He was previously with the American Electrical Heater Co., Micromatic Hone and Kelsey-Hayes. Various phases of tool engineering were covered when he attended several years of night school at the Detroit College of Applied Science. His earlier experience includes work at a screw machine factory while attending high school.

Win a *Handbook!*

Do you have problems you'd like solved by the 35 experts participating in ASTE's panel conferences at the Annual Meeting in Philadelphia? Fifteen *Tool Engineers Handbooks*, three for each of the five panels, will be awarded for the most timely and interesting questions submitted before April 1. Get yours in the mail today! Send them to:

ASTE National Headquarters
10700 Puritan Ave.
Detroit 38, Mich.

Joseph I. Karash has been with Reliance Electric & Engineering Co., Cleveland, O., for 23 years serving in most phases of manufacturing: tool and die design, plant engineering, process engineering, safety engineering, and product development. He has written many articles on various tool engineering subjects and is author of the book *Analysis of Drill Jig Design*. Many groups and technical societies have heard his lectures.

Philip Lindhuber is chief tool designer of the Spicer Mfg. Co., Toledo, O., a division of the Dana Corp. He joined the company in 1929 as a tool


Balciunas


Cole


Karash


Lindhuber


Newton


Rotchford

designer and in 1940 was promoted to his present position. He was previously with the Toledo General Mfg. Co. A registered professional engineer, Mr. Lindhuber has written technical articles for publication in industrial magazines.

Robert W. Newton is general tool analyzer for International Business Machining Corp., Poughkeepsie, N. Y. He was formerly assistant chief tool designer with New York Air Brake Co. and before that associated with the Glenn L. Martin Co., designing tools and processing routings for the B-26 bomber. In addition to much practical experience, his education includes courses at the Syracuse University Extension School and Oswego State Teachers College.

John E. Rotchford is vice president and sales manager of Lodding, Inc., Worcester, Mass. He joined the firm in 1950 and the following year was promoted to his present position. Specializing in jig and fixture design for the 12 years, he was formerly general superintendent at Cashin Co., Boston, Mass.

The many rewards from employing 'handicapped' persons were discussed at a Long Island meeting by Henry Viscardi, standing, far left, president of Abilities, Inc. Shown with him are Chapter Chairman Arthur Cervenka, Frank Reiger and Frank Martindell, a member of the National Program Committee. Seated are Arthur Nierenburg and James Wadsworth.

Long Island Members Invite Families to Visit Typical Business Meeting

Long Island—Families and friends of ASTE members found out what goes on at a typical business meeting of the Long Island chapter when they attended the group's ladies' night program on December 14. More than 125 persons were on hand for the unusual program held in the main ballroom of the Garden City Hotel.

Chairman Arthur Cervenka called the meeting to order and welcomed the many guests and the featured speaker, Henry Viscardi, president of Abilities, Inc., West Hempstead, N. Y.

In prompt sequence Secretary John Hatter read the minutes of the previous meeting; Treasurer Max Stein gave a brief statement of the chapter's financial picture; and Membership Chairman William Lamberta announced that the roster now lists 531 members—a tremendous advance made during the past 33 months—and Program Chairman John Barnes announced the details of the chapter's next technical program.

After the business session was concluded, George Bennett, first vice chairman, introduced Delegate Sheldon Meyers who welcomed the ladies in a well-received talk on the services of the American Society of Tool Engineers. He explained the many activities supported on a national level by ASTE and outlined the variety of programs and functions of the Long Island chapter.

Four affiliate membership plaques were presented by Membership Chairman Lamberta. Recipients were: Sid Jacobson, representing Sid Tool Co.; Bernard Salvatore, Mechaneers, Inc.; Wally Ebner, Long Island Machinery Sales Co.; and Max Stein, Republic Aviation Corp.

The guest speaker, Mr. Viscardi, is known to thousands of Americans as the leader of the nation's so-called "handicapped" persons. Author of the book *A Man's Stature*, his articles have appeared in "Collier's," "American Magazine," "Reader's Digest," and several industrial publications.

"Production from the Slag Pile of Human Resources" was the startling topic chosen for his talk. He knows it well. Born without legs, this courageous man worked his way through Fordham University and St. John's Law School, went through Army basic training at Fort Dix as a Red Cross field representative and worked at Walter Reed Hospital during World War II.

Today, as president of Abilities, Inc., he employs only physically disabled persons, and proves that his company can compete with any other firm on the open market. But the biggest return of Abilities, Inc. is that it is proof that 73 citizens who were tax burdens on relief rolls, in private charity or to their families, are now self-supporting and productive.

Mr. Viscardi reported that his company has a phenomenally low rate of absenteeism, few accidents on the job and an extremely high production record. —*Sara T. Moxley*

Article Written by President Waindle

In an article published in a recent issue of *Mill and Factory*, ASTE National President Roger F. Waindle disclosed that 30 per cent of machining equipment in industry is obsolete and 34 per cent of inspection methods are obsolete. Discussing present amortization and depreciation regulations, Mr. Waindle said that more than 28 per cent of the nation's production equipment is outdated or worn out.

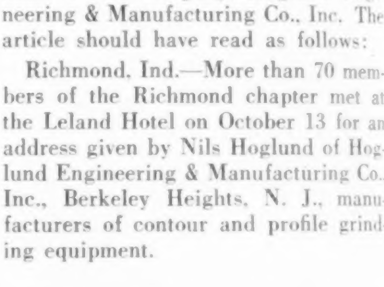
His message was the lead article in the December issue of the industrial publication.

Correction

Nils Hoglund Addresses Richmond ASTE Chapter

Through a regrettable error, the article reporting the lecture of Nils Hoglund at a meeting of the Richmond, Ind., chapter, published in the December TOOL ENGINEER, gave the wrong spelling of Mr. Hoglund's name and the name of his company, Hoglund Engineering & Manufacturing Co., Inc. The article should have read as follows:

Richmond, Ind.—More than 70 members of the Richmond chapter met at the Leland Hotel on October 13 for an address given by Nils Hoglund of Hoglund Engineering & Manufacturing Co., Inc., Berkeley Heights, N. J., manufacturers of contour and profile grinding equipment.



Nils Hoglund

His subject "Toolroom Contour Grinding Now a Production Reality" embraced the methods and history of profile grinding. It was appropriately illustrated by blackboard sketches.

Considerable interest in Mr. Hoglund's discussion was displayed during the formal part of the program and also while the lively question and answer period was in session.

Interest Grows in Forming Sub-Chapter

Pocatello, Idaho—Several officers of the Salt Lake City ASTE chapter met on November 21 with interested engineers from Pocatello to stimulate interest in forming an affiliate chapter of the Salt Lake City group.

Among those present for the session were: Prof. Frederick Preator, Salt Lake City chairman and member of the ASTE National Education Committee; Leslie C. Seager, member of the National Constitution and By-Laws Committee; Jack Woodhead, Salt Lake City program chairman; Prof. A. L. Lillibridge, Idaho State College; C. N. Perkins, production planner, Naval Ordnance plant; and Mr. Houts, United States Naval Gun Factory.

Acting chairman for the meeting was Harry Todd of the Salt Lake City chapter. —*Reid L. Rice*

F. Ernest, president of Holderman & Collet Co., Elkhart, Indiana, presented a talk entitled "Internal and External Chucking" to the Fort Wayne chapter audience of 70 on December 9. From left, Donald D. Welbaum, chairman of the chapter and Mr. Ernest. Editorial Chairman Richard Spaw reports the showing of a movie on apprenticeships also at the meeting.

Utah Engineering Council Elects New Officers

Leslie C. Seager, chief production tool engineer, The Eimco Corp., was elected president of the Utah Engineering Council at a meeting held December 15 at the Congress Hotel in Salt Lake City.

Mr. Seager, who represents ASTE on the council, and is also a member of the National Constitution and By-Laws Committee, succeeds Milton T. Wilson, district engineer, United States Geological Survey. Other officers named are: F. C. Bates, vice president; Paul Worthen, secretary; and Robert Sanks, treasurer.

George L. Boehm

Industrial Uses of Wax Reviewed at St. Louis

St. Louis—Some 254 members and guests turned out for the December 3 meeting at the DeSoto Hotel to hear George L. Boehm, chief sales engineer, Industrial Products Department, S. C. Johnson & Son, Inc., Racine, Wis. Mr. Boehm's topic was "Metalworking with Wax—Production History."

He described the practical use of wax in cutting, drawing and working of metals which is a comparatively new process. During his talk Mr. Boehm attributed the success of wax in cutting to the fact that the wax particles, only 1/500 micron in size, are in a constant state of turbulence in the fluid medium, and they have a tremendous capacity for absorbing heat, thereby taking it away from the work, the tool and the chip. —*E. Graser, Jr.*

News Contest

Long Island and Lima Take Top Honors

Winners of THE TOOL ENGINEER's contest for outstanding chapter news coverage were announced on January 11 by Joseph L. Petz, chairman of the National Editorial Committee.

Mrs. Sara T. Moxley, editorial chairman of the Long Island chapter, submitted the best and most complete coverage over a three-month period and Donald Cox, chairman of Lima chapter's editorial committee, contributed the best individual news report.

For their superior efforts in covering ASTE chapter activities, both winners will receive copies of the *Tool Engineers Handbook*, with their names inscribed in gold, and appropriately designed plaques.

Members of the National Editorial Committee, who judged the contest entries, decided to award the plaques April 28 at the Membership Banquet of the Annual Meeting and to pay the expenses of each winner to and from Philadelphia.

Overwhelming response to the contest (a total of 207 reports were received during the three-month period) made the task of selecting winners extremely difficult. Ten honorable mention awards were quickly established.

Space limitations for this last-minute news, written just at press time, make it necessary to postpone announcement of these special award winners until the March issue of the magazine.

ASTE Announces 1954 Education Awards for Outstanding Engineering Students

As part of its program to help alleviate the critical engineering shortage which faces production men today, ASTE has announced for the fourth consecutive year the continuation of its International Education Awards for 1954. The awards will total $7000 for deserving engineering students and become effective at the beginning of fall term this year.

Ten awards of $700 each will go to nine students in recognized U. S. universities and one Canadian student, who meet the standards set up by members of the National Education Committee who will act as judges.

In order to be considered eligible for an award, the student's course of studies must include those that prepare him for future work in tool and production engineering. He must also be a third-year student in a four-year curriculum, a third or fourth-year student in an undergraduate five-year curriculum, or a senior who will continue graduate work in the following fifth year. He must also be a full-time student.

Although the grants will be made on an annual award basis, the student must maintain satisfactory grades to receive the balance of the award.

A deadline, March 31, has been set for submitting applications. Along with the application, the student will be required to submit preferred references of faculty advisors or counselors to evidence the individual's genuine interest and aptitude in his chosen field.

Among the 320 members and guests who were present for the Los Angeles party were, from left: Mrs. William Hughes, Oliver J. Smith, Mrs. Charles C. Scheurer, Carl E. Almquist, Mr. Scheurer, Mrs. Almquist, Mr. Hughes and Mrs. Smith. The event was held at the Deauville Beach Club on December 11. In the right hand photo are pictured national and chapter officers who were present: Paul Lenk, secretary; Frank Bale, treasurer; Paul Slater, second vice chairman; Ralph Chrissie, member of the National Program Committee and contributor of these pictures; Carl Almquist, chairman; Ben Hazewinkel, national director; and Wayne Ewing, national assistant secretary-treasurer.

Parties Highlight Chapter Agendas During the Christmas Holidays

Christmas parties proved to be successful substitutes for December technical meetings for a number of ASTE chapters. The holidays also provided the ideal occasion for many groups to invite ASTE wives to participate in a chapter program.

When Santa Clara Valley staged its second annual Christmas dinner-dance, Mr. and Mrs. William Vossbrink were given a food mixer, one of the many prizes awarded at the party. More than 70 members and their wives attended the event. —*Glenn Herreman*

At the Christmas program held by the Fox River Valley chapter, Charles A. Olson, left, was presented with a chapter life membership by Chairman Phil Shaner. Nearly 170 members and their wives witnessed the ceremony held at the Baker Hotel in St. Charles. Dinner and dancing rounded out the program. —*W. C. Perkins*

In Dayton more than 100 couples enjoyed the dinner dance held at Miami Valley Country Club, according to W. J. Killinger. Entertainment Chairman Vic Boll and his committee made all arrangements. Music was furnished by the Saum Brothers orchestra.

Albuquerque members held their ladies' night at Leonard's Restaurant. Gifts of jewelry were given to the guests of the chapter. The program was presented by Joseph Toulouse who gave an illustrated talk on the history of the Southwest, reports Herbert E. Anderson.

The Crystal Ballroom of the Hotel Jamestown, Jamestown, N. Y., was the setting for the first annual dinner dance of the Chautauqua-Warren chapter, writes Laurence R. Green. Chairman Robert J. Wilson welcomed a crowd of more than 140 members and guests. Party arrangements were made by Richard Misener and his committee: Gordon Carlson, Leslie Beau Jean, Norman Walter, Paul Anderson, Herbert Cave, Lindsley Brown and Mr. Wilson.

Philadelphia's annual party has always operated on the "no guests" principle, reports Jack Schroth, and the 1953 event was no exception. A total of 460 members gathered at the Broadwood Hotel for dinner and a program of entertainment.

One of the favorite meeting spots of the Saginaw Valley chapter, Zehnder's Hotel in Frankenmuth, was chosen for their party. Professional entertainment, awarding of prizes and the renowned chicken dinners attracted an attendance of 391 members and guests, according to Kent B. Arnold.

Rockford chapter celebrated the holidays at Forest Hills Country Club with a ladies' night program. About 135 couples were on hand for dinner and dancing. Music was provided by the Benny Sharp trio and entertainment was furnished by Tom Martin, writes Kenneth Hull.

Indianapolis Program

Indianapolis members and their guests gathered at the Sahara Grotto for their dinner dance, according to M. B. Rosenbarger. Chairman Joe Penn introduced all officers and committee to an audience of more than 200 persons. Corsages were provided by Standard Die Supply Co., and the reception was sponsored by Danly Machine Specialties Co.

A program of dancing, dinner, prize winning and entertainment greeted the

(Continued on next page)

300 [illegible]bers and guests who attended the [illegible] Cities party, Earl Tenpound writ[illegible] The event was held at the Moli[illegible] Elks Hall. Dick Boltz and his orch[illegible]a furnished the music.

Al[illegible]a Country Club was the location [illegible] Pittsburgh chapter's annual part[illegible] according to a report by E. L. Caughey. Dinner was served buffet style before the dancing program got under way. Program Chairman Edward Phillips and his committees were in charge of arrangements.

Columbus ASTE members and their guests held their holiday program at Beechwold Restaurant. A reception preceded the steak dinner and a program of entertainment rounded out the evening, writes Roscoe V. Zwoll.

At Los Alamos nearly 95 members and their wives enjoyed dinner and dancing at the Civic Club. Chapter business was confined to choosing the nominating committee and the administration of the oath of office to Treasurer Robert Kee and First Vice Chairman Vong Steeg, who reported the event.

Worcester's annual holiday party was attended by more than 200 chapter members and their guests. The program included a reception, dinner, entertainment and dancing. Vic Ericson was master of ceremonies. Seated at the head table were: Treasurer A. E. Peterson and Mrs. Peterson; Second Vice Chairman Adam Kosciusco and Mrs. Kosciusco; First Vice Chairman Louis J. Furman and Mrs. Furman; Chairman and John E. Rotchford and Mrs. Rotchford; Secretary J. Irving England and Miss Mary Clancy; and Don Eaton (who was in charge of arrangements for the party) and Mrs. Eaton.—*A. H. Shairman*

Long Beach Party

Long Beach chapter's annual Christmas dinner dance was staged in the Marine Room of the Wilton Hotel. A crowd of 200 members and guests attended. Prizes were awarded and an affiliate membership plaque was awarded to the Bay City Bearing Co., reports J. J. Smith.

Rawling Country Club was the site for the Nashville party, says J. E. Wilkinson. About 70 members and guests enjoyed the holiday program of dinner and dancing.

Toronto members couldn't quite forsake their technical program in December so they held a party before hearing a talk on "Modern Machining Methods" made by H. E. Neal of the Bullard Co. About 135 members attended the meeting which also featured a Christmas tree, gifts for eight past chairmen, and a social session, reports A. McKinney Rice.

ASTE National Director Richard Smith was guest of honor at the annual party held by the New Haven chapter at the New Haven Country Club. His brief talk on tool engineering, a reception sponsored by Crucible Steel Co., dinner and dancing made up the holiday event, according to Silas W. Becroft. About 140 persons attended.

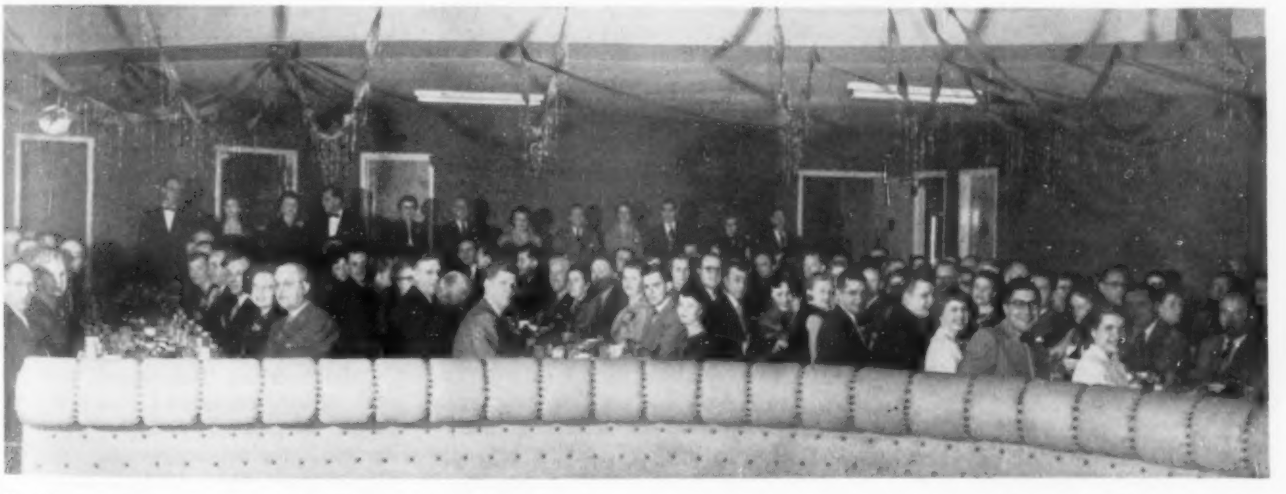
Lima Dinner Dance

Lima's dinner dance was held at the Royal Pine Room and drew a large attendance, write Donald Cox. Corsages were given to the ladies and prizes were awarded during the evening. Entertainment filled out the enjoyable evening. Program Chairman W. E. Epley and his committee were in charge of arrangements.

At the Denver Christmas party, 40 members and their guests met for a program which included the showing of several entertaining films, reports James M. Johnson.

Close to 90 members and guests of the Salt Lake City chapter helped make the group's fourth annual Christmas party a real success. Credit must be given also to the committee who planned all arrangements—Mrs. Leslie Seager, Bill Taylor and Dan Probert, Reid L. Rice reports. Prizes were awarded and dinner and dancing made up the rest of the program.

News and photographs of other chapter parties held at Christmas time will be published in the March issue of The Tool Engineer magazine.



Binghamton chapter officers (standing) are pictured at the annual dinner dance held during the Christmas holiday at the Vestal American Legion. More than 60 couples were entertained at the event. After dinner a short welcoming address was given by Chairman Howard D. Bertholf. New members were introduced by Harry Strauss, Jr., chairman of the membership committee. An automatic electric coffee maker was presented to Mrs. William Loesch.—*C. L. King*

New Appointment

C. L. Fanning Named to Standards Committee

George F. Bryan, chairman of the National Standards Committee of ASTE, has announced the appointment of a new member to his committee. He is C. L. Fanning, assistant chairman of the Machine and Wood Shops at General Motors Institute, Flint, Mich.

C. L. Fanning

A past chairman of the Saginaw Valley chapter, Mr. Fanning has held all elected offices in the chapter, including representative at two sessions of the House of Delegates, and served as chairman of the education committee for several years.

Associated with General Motors Institute for the past 25 years, he is also supervisor of the carbide tool training program which has been established in many GM plants and has been institute supervisor of numerous fifth-year project students when their projects were in the field of tooling or related subjects. He is a graduate of the Reo Machinists Apprenticeship course and of the Tri-State College of Engineering at Angola, Ind.

Pictured at Wichita's December meeting these ASTE officers and Carboloy representatives: J. D. Kennedy, Chairman A. A. Reddy, Grant Morrison, L. L. DeCoster, Program Chairman E. F. Baker, and First Vice Chairman E. F. Baker.

Cemented Carbides Topic at Wichita Program

Wichita—L. L. De Coster, manager of the midwestern district of Carboloy Dept., General Electric Co., was the technical speaker at a meeting of the Wichita chapter held December 9. Using slides to illustrate his talk on "New Developments in Cemented Carbides," he discussed the advantages of using the hardest known substance made by man.

He covered physical properties of cemented carbides, deep hole trepanning, drilling of cast iron, high temperature alloy machining, high-speed machining, and cemented chromium carbide. "Almost any machining problem can be solved by using tungsten, chromium and titanium carbides," he said.

—John G. Temple

Positions Wanted

SALES REPRESENTATIVE—with 15 years' experience in automotive and aircraft companies desires position in Detroit area. Experience includes aircraft tools of all types, precision and assembly tools. Have also handled all phases of tool designing, product designing, processing and manufacture in this field. In the automotive field, my experience has been tool designing, dies, estimating, machine parts, and stampings. For complete resume, write to Box 090, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

NORTHERN CALIFORNIA REPRESENTATION—Can provide intensive, capable coverage on tooling, inspection, machinery. New organization headed by successful sales engineer with exceptional technical and sales experience. Well acquainted with distributors and consumers. Please write Box 212, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

Smiles indicate that a successful technical session has just been completed at Springfield, Mass. Shown are: Peter F. Scott, first vice chairman; C. B. Schaefer, director of sales, Abbott Ball Co., Hartford, Conn.; R. J. Hamm, experimental engineer, American Optical Co., Southbridge, Mass.; W. B. Sanders, vice president and technical director, Mosher Co., Chicopee, Mass.; and Robert M. Dickson, chairman of the Springfield chapter.

North Texas Meeting Deals with Uses of Wax

Some 75 members and guests attended the last meeting of 1953 for the North Texas chapter at Amon Carter International Airport on December 11. The technical session, after dinner, consisted of a talk by George L. Boehm, chief sales engineer, S. C. Johnson and Son, Inc., Racine, Wis.

"Metalworking Techniques" was the topic Mr. Boehm chose for his talk. He helped the members to explore the uses of wax in the art for forming and machining metals, embracing the types and sources of the raw wax products and the processes of refinement. Slides in color helped to illustrate the processes.

—F. Paul Simpson

Portland Reviews Machine Knives

Portland, Me.—The Columbia Hotel was the scene of the December 11 meeting of the Portland chapter. It was revealed at the business session that the committee working with the State Director of Vocational Training is progressing rapidly.

Charles Edwards, of Simonds Saw and Steel Co., presented a talk on "Machine Knives in Industry" at the technical session. Mr. Edwards showed a sound film and discussed cutting wood by modern methods in the paper industry. He also showed the type of knife suitable for cutting plywood.

Special guests at the meeting were Mr. Hutchinson, principal, Vocational Training, South Portland, Me., and two students. —*Henry C. Hagman*

Lima Member Presents Program at University

E. R. Wagner, chairman of the Lima chapter professional engineering committee, presented a program covering "The Forces in Single-Point Tool Metal Cutting" on December 10. The presentation was made at Ohio Northern University at the Mechanical Engineers Club to forty listeners. —*Donald Cox*

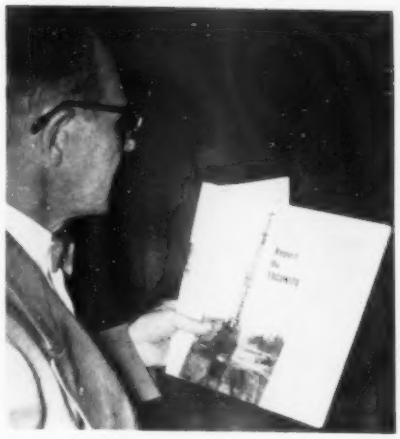
Springfield Chapter Visits Machine Tool Co.

Springfield, O.—The Springfield Machine Tool Co. was host to 65 ASTE members and guests at the December 8 meeting. Chapter Chairman R. C. Montanus, vice president of the firm, presided at the meeting and also delivered the main address. His topic was "The Practical Aspects of Tracer Controlled Turning."

After his talk, he exhibited several lathes, including a specially designed lathe to turn shotgun barrels.

Nondestructive Testing Topic at Monthly Meeting

Athol, Mass.—Some 176 members and guests of the Northern Massachusetts chapter met at Lithuanian Hall on December 15 for dinner and technical session. The main speaker for the evening was Francis G. Tatnall, manager of testing research, Baldwin-Lima-Hamilton Corp. He chose "New Developments in Nondestructive Testing" as his topic. —*Leslie H. Laughton*



William Keller

San Diego Members Hear Talk on Taconite

San Diego—William Keller, editorial chairman for the San Diego ASTE chapter, dropped his role of 'field editor' for THE TOOL ENGINEER to take over that of the technical speaker at the December 8 meeting of his chapter. He spoke on the subject "Engineers Chart the Future in Taconite Mining." The dinner session was held at the El Morocco Cafe.

Members elected the nominating committee to select the slate of officers for the chapter's annual election. Future programs were also discussed. Entertainment was provided by Miss Barbara Richards, a professional dancer in San Diego.

In his talk, Mr. Keller discussed processing methods being developed by engineers for removing iron ore from taconite and the economic factors involved in these processes. —*William Keller*

Greater Lancaster Holds Ladies' Night

Lancaster—The Brunswick Hotel Ballroom was the scene of Ladies' Night for the Greater Lancaster chapter on December 1. Dinner and music by the "Stevadors" from Stevens Trade School, was followed by a short business session in which a nominating committee was chosen for the coming elections. The committee will consist of J. H. Resser, chairman, assisted by Kenneth Burnhart and George Gallagher.

Louis P. Shannon, eastern district manager, the E. I. DuPont de Nemours Co., Wilmington, Delaware, was the guest speaker. Mr. Shannon related the story of American progress by exhibiting developments resulting from chemical research. He also showed a technicolor film, "The DuPont Story." —*George Gallagher*

Boeing Airplane Co. Promotes Wichita Members

Three promotions announced recently at Boeing Airplane Co., Wichita, Kan., concerned active members of the Wichita ASTE chapter. Dave Weaver was named assistant general superintendent of tooling, Walter E. Burnham was appointed to succeed him as chief of tool engineering, and Harold J. Bales was named to succeed Mr. Burnham as chief of tool design. The announcements were made by T. C. Pitts, factory manager, and J. W. Kingston, general superintendent of tooling.

Mr. Weaver has been with Boeing for the past 14 years. His first position was in Seattle in 1939 and subsequent assignments have taken him all over the United States.

Associated with aircraft engineering and tooling since 1924, Mr. Burnham is third vice chairman of the ASTE chapter. Before joining Boeing in 1934, he helped to design the plane which won the Thompson Trophy race in Cleveland in 1929.

Now serving as executive vice president of the Boeing Supervisors Club, Mr. Bales has been with the company since 1941. He has held a number of ASTE posts with the Wichita chapter and has filled all of the elective offices since joining the group as a charter member.

ASTE Chapter Chairman Addresses NEMA Meeting

Hartley W. Barclay, chairman of the Greater New York chapter and industrial advertising manager of *The New York Times*, was one of the featured speakers at the annual meeting of the National Electrical Manufacturers Association held in November at Atlantic City, N. J.

Speaking on the topic "Your Future Is Greater Than You Think—But You Must Work for It," Mr. Barclay cited the recent report made by ASTE on industrial obsolescense.

Robert Wolff Promoted

Arriving too late to be included in an article appearing in the January TOOL ENGINEER, announcement has been made of the promotion of Robert E. Wolff to marketing manager of the Tool and Machine Division at Illinois Tool Works. Mr. Wolff, recently appointed to serve on ASTE's National Education Committee, was formerly assistant marketing manager at the Chicago company's Tool and Machine Division.

Students took charge of all program plans for Peoria's Annual Student Night. Pictured here are: Charles Jeffries, student technical chairman; Richard Atterberry, chairman of the student section; Werner I. Senger, speaker from Gisholt Machine Co., Madison, Wis.; Robert Bayless and Duane Brighton, both past chairmen of Peoria chapter.

Annual Student Night Held by Peoria Chapter

Peoria—All the arrangments for the evening's program on December 8 were made by Peoria's student section. Some 110 turned out for the event at the Morton American Legion Hall. The students chose as their speaker Werner I. Senger, manager, Balancing Machine Division, Gisholt Machine Co., Madison, Wis. Using slides to augment his talk, Mr. Senger spoke on "Dynamic and Static Balancing," upon which he has written an article appearing in the *Tool Engineers Handbook*, first edition.

Charles Jeffries, a four-year machine apprentice at Caterpillar Tractor Co., had complete charge of the program. Four new members were added to the Peoria roster this month. They are: Alfred Bacon, Dean Riggenbach, Donald Livinston and Thomas MacFarlane.

—Russ Saurs

December Banquet Held at Hartford

Hartford, Conn.—December 7th found members and guests enjoying a Father, Son and Daughter Night at the City Club of Hartford. The program included a talk by Robert M. Schultz, superintendent of recreation for the city of Bridgeport, Conn. His subject was "Bavarian Youth," illustrated by slides of youth activities in Western Germany.

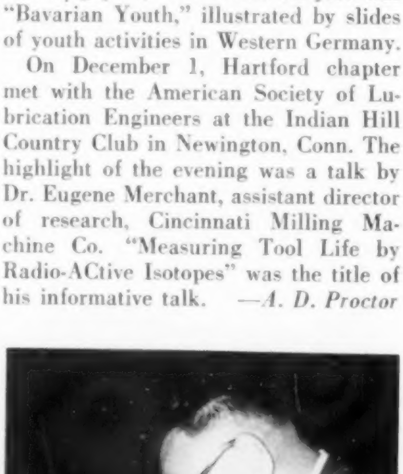
On December 1, Hartford chapter met with the American Society of Lubrication Engineers at the Indian Hill Country Club in Newington, Conn. The highlight of the evening was a talk by Dr. Eugene Merchant, assistant director of research, Cincinnati Milling Machine Co. "Measuring Tool Life by Radio-ACtive Isotopes" was the title of his informative talk. *—A. D. Proctor*

Carbide Tool Design Discussed at Piedmont

Charlotte, N. C.—Piedmont's last meeting of 1953 was held at the Elk's Club on December 14 and 58 members and guests attended. "Developments in Carbide Tool Design" was the topic of a talk given by Bennett Burgoon, Jr., sales manager, Metalworking Division, Kennametal Inc., Latrobe, Pa.

Mr. Burgoon first described the development of the various grades of carbides, showing that all carbide cutting grades fall into three general classifications—crater resistant, edge wear resistant, and the intermediate crater and edge wear resistant. He also explained Kennametal's technique of tool wear analysis, showing how their field engineers use it for trouble-shooting.

—Henry H. Palmer



Springfield Meeting Features Three Speakers

Springfield, Mass.—On December 14, members of the Springfield chapter met at the Student Prince Restaurant for dinner and 95 turned out for the ensuing technical session and business meeting.

The business session included the selection of a nominating committee for 1954 election to consist of Walter Kuczek, William Buckley and Fred Wilcox. Mr. Buckley will serve as chairman of the committee. Wendell Ingham gave an outline of Springfield chapter history which will be published at a later date.

Panel Members

The technical portion of the meeting featured talks by three speakers on the single subject "Metal Finishing by Tumbling." Speakers were: Wayne B. Sanders, vice president and director, Mosher Co., Chicopee, Mass.; C. B. Schaefer, director of sales, Abbott Ball Co., Hartford, Conn.; and R. J. Hamm, experimental engineer, American Optical Co., Frame Division, Southbridge, Mass.

An interesting feature was the exhibition of a specially made working model tumbling machine with the drum made of clear plastic so the action inside could be studied. It was donated for the evening by the American Bosch Corp. through the efforts of one of its employees, James Henry, production engineer.

Guests Attending

Special guests of the chapter during the evening were: Minor Frost, Jr., sales representative, Magnus Chemical Co., Garwood, N. J.; Bernard H. Bailey, Jr., president, and Alexander Simpson, treasurer, Deburring & Burnishing Corp., Danvers, Mass.; Med Pontbriand, Frame Division foreman, and Fryderyk R. Noga, assistant to the speaker, Mr. Hamm, from American Optical Co. *—Robert M. Drennan*

Pictured at a recent meeting of the Springfield, Mass., chapter are these program speakers. The main talk was delivered by Harlan W. Sewybolt, right, general foreman, Tool Div., Westinghouse Electric Co. Others, left to right, are: Peter F. Scott, tool engineer, Wico Electric Co., and John T. Thomas, manager of production at Westinghouse.

Shown at the South Bend meeting are: James W. Dopp, speaker and field service engineer with the LaPointe Machine Tool Co.; Hudson, Mass.; James Kemp, chairman of the South Bend chapter; Joseph P. Crosby, first vice president of ASTE, and vice president of LaPointe Machine Tool Co.; and John Yoder.

Positions Available

TOOL AND MACHINE DESIGNERS—

One of Cincinnati's largest permanent design firms has openings in their own office for experienced machine product and tool designers, and detailers.

Recent engineering graduates or students will also be given consideration. These are permanent positions with a substantial, stable leader in the field. We can offer top starting wages, modern working conditions, paid holidays, vacations, and other benefits. Our policies assure varied experience and unusual opportunities with a future.

New employees would be expected to settle on a permanent basis in Cincinnati. Please send resume to Cincinnati Designing, Inc., 8120 Blue Ash Ave., Cincinnati 36, Ohio.

Chairman Discusses April Tool Exposition

Williamsport, Pa.—The December 14 meeting of the Williamsport chapter was held at Home Dairy Cafeteria. Preceding the technical session, Chairman William McCoy outlined plans for the ASTE Convention and Exposition in Philadelphia next April and a nominating committee was selected with Morris Smith as chairman.

The technical session featured a talk by Robert Seaton and Fred Krsek, sales engineers of Allen-Bradley Co., Milwaukee. Their topic was "Applications and Uses of Motor Control," in which they utilized slides showing motor control from inception to present modern design. Safety, automatic starting, dust proofing, water and explosion proofing features were shown. —*John L. Balint*

Patent Attorney Addresses Kansas City Chapter

Kansas City, Mo.—Members of the Kansas City chapter met at Roselli's Restaurant on December 2 to hear C. Earl Hovey, patent attorney and instructor at the University of Kansas City. He told members how to get their gadgets and devices patented and gave some humorous sidelights of patents that have been issued. Some 53 members were on hand. —*Richard W. Corliss*

Plant Tour Draws 70 Denver Members

Denver—About 70 ASTE members from the Denver chapter traveled to Pueblo, Colo. on December 5 to visit the Colorado Fuel and Iron Corp. After the tour which enabled them to observe most of the plant operations, they were guests at a dinner given by company officials. Rudy Smith, works manager of the Pueblo plant, acted as host for the meeting. —*James M. Johnson*

Named Superintendent

R. O. Willoughby has been made superintendent of ordnance for the Canton Plant of E. W. Bliss Co. Mr. Willoughby joins Bliss after service as a monitor for the Air Force's heavy press program.

Eastling Promoted

Announcement has been made of the appointment of Harvey V. Eastling as the general manager of the Link-Belt Co's Pacific Division with headquarters in San Francisco. Mr. Eastling, who started his Link-Belt career in 1925, succeeds Ralph M. Hoffman who is retiring after 40 years of service.

Joseph Crosby Visits South Bend Chapter

South Bend—When the South Bend chapter met at Izaak Walton League Club House recently, Joseph P. Crosby, first vice president of ASTE and vice president of Lapointe Machine Tool Co., Hudson, Mass., was a special guest. Mr. Crosby spoke on "The Importance of the Tool Engineer."

During the business portion of the meeting, the nominating committee presented its slate of candidates for 1954 who are: Harold Housewerth, chairman; John R. Berker, first vice chairman; E. James Nelson, second vice chairman; John D. Cook, secretary; and Matthew J. Nowak, treasurer.

In the technical session that followed, James W. Dopp, field service engineer of the Lapointe Machine Tool Co., presented a historical review on broaching and showed two films, "Jet Propulsion" and "Automotive Broaching." A forty-five-minute film on the Cummins Diesel Racer was also shown.

—*Matthew J. Nowak*

Richmond Chapter Hears Avco Master Mechanic

Richmond, Ind.—A. C. Good, master mechanic at Avco Division of Crosley Corp., was the featured speaker at the December meeting of the Richmond ASTE chapter. His subject was "Aspects of Design for Economy of Fabrication and Maintenance."

Mr. Good shared his many years of experience with an audience of 65 members and guests. In his discussion of part design, processing and the designing of tools, he stressed the necessity of a good locating surface from which to machine, even though it requires pads or bosses to machine off after operations are completed.

A number of guests from Avco were present for the dinner meeting held at the Leland Hotel.

—*E. L. Hale.*

Ladies' Night Meeting Held at Baltimore

Baltimore—December 2 was the date selected by members of the Baltimore chapter for their annual ladies' night meeting. The program included a hobby craft demonstration given by Orton Gouchnour of the Arts & Crafts Supply Co. A film entitled "Unfinished Rainbows" illustrated the story of aluminum for the chapter and its guests.

—*C. G. Kelly*

NAM Speaker Addresses Mid-Hudson Meeting

Poughkeepsie, N. Y.—"Meeting the Modern Challenge" was the topic of an address given to 120 members and guests of the Mid-Hudson chapter at their December meeting. The program was presented by Dr. Allen A. Stockdale, staff speak refor the National Association of Manufacturers.

He said problems of everyday life should be met with humor rather than with a disgruntled attitude. "Find the humor in the problem and then proceed to solve it," the speaker urged.

He also pointed out that in the next seven or eight years some eight million boys and girls will be graduating from schools and colleges and will be requiring jobs. To create these jobs, men with financial backing and initiative must begin planning and working now to meet the challenge. "It costs about $12,000 to create just one job," Dr. Stockdale said.

The coffee speaker at the dinner meeting was Dean Temple, executive secretary of the YMCA, who described the history of the "Y" and its work in the community.

New members introduced at the meeting were: William E. Mahon, Salvatore J. Cerniglia, William B. Sheldon, Jr., Henry Norling, Timothy Meade Ryan, William J. Kistner, Fred L. Kolts, Mahlon R. Blackman and Stanley J. Waligora. —*Harold J. DePew*

Training School Head Speaks at New Orleans

New Orleans—Robert Kessler, head of the Cincinnati Milling Machine Training School, spoke before 70 members of the New Orleans chapter at Tulane University on December 8.

Mr. Kessler, with the aid of slides, presented his talk entitled "Modern Milling Machines" which reviewed the basic types of milling machines and the various methods of milling.

The speaker also presented the color movie "Highway to Production," produced by his company, on the milling machine industry.

As coffee speaker Nash Roberts, private weather consultant and local television personality, gave an informative talk on the weatherman's place in industry. He pointed out how industry uses the services of a private weather consultant, such as predicting favorable weather conditions for moving drilling rigs in the Gulf, and for performing large roofing jobs, pouring concrete, and so on. —*P. A. Young, Jr.*

Keystone's November meeting at Hotel Casey in Scranton, Pa., featured a talk by Charles DeVlieg on "Precision Boring." From left are: Mr. DeVlieg and Jack Lipman, chairman of the Keystone chapter. Joseph Kopin reported a successful meeting.

Niagara District Discusses Hydraulics

Welland, Ont.—Niagara District's regular monthly meeting, held at the Barclay Hotel on December 3, was devoted to a talk by G. R. Miller, chief engineer, Racine Hydraulics & Machinery, Inc.

In covering his subject, "Applied Hydraulics in Industrial Application," Mr. Miller discussed the advantages and assets enjoyed in using hydraulic machinery. Approximately 60 members and guests were on hand and hosts for the evening were Upton Bradeen and James Machinery Co., Ltd. —*William A. Yaeger*

Lapping Engineer Talks at Peterborough Meeting

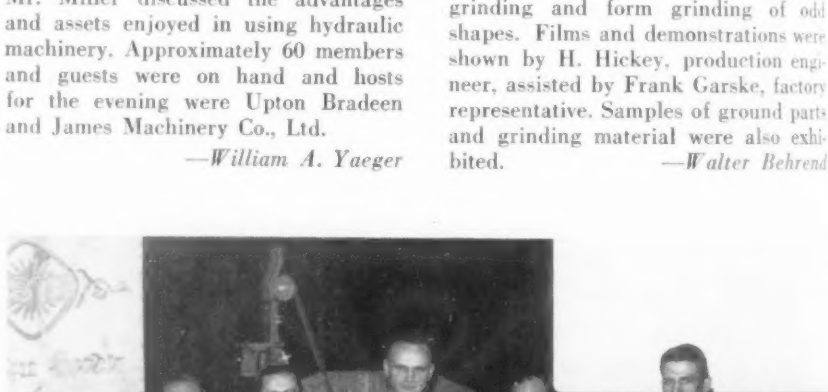
Peterborough, Ont.—Some [illegible] members of the Peterborough District chapter met at the Empress Hotel for their regular dinner meeting and technical session on December 3. Gustaf A. Anderson, lapping engineer, Norton Co., Detroit, was the main speaker in the meeting sponsored by J. H. Ryder Machinery Co., Ltd., Toronto, Ont.

The talk was illustrated with examples of fine finishes obtained in large scale production, utilizing standard precision grinding and lapping equipment. —*Fred H. Mason*

Milwaukee Reviews Coated Abrasives

Milwaukee—Members and guests, 84 strong, gathered at the Milwaukee Serb Memorial Hall for the regular monthly meeting on December 10. On the lighter side before the technical session began and during coffee, a color film "Moose Hunting in Alaska" was shown.

W. A. Corse, assistant sales engineer, The Carborundum Co., Niagara Falls, N. Y., was the guest technical speaker and his topic was "Coated Abrasives in Industry." In his talk, Mr. Corse discussed the basic requirements in removal of material by abrasive and belt grinding and form grinding of odd shapes. Films and demonstrations were shown by H. Hickey, production engineer, assisted by Frank Garske, factory representative. Samples of ground parts and grinding material were also exhibited. —*Walter Behrend*



After an enlightening technical session at Milwaukee's regular monthly meeting, the camera's eye catches: left to right, R. Bodendoerfer, first vice chairman; E. Anspach, chairman; W. A. Corse, speaker from Carborundum Co.; Frank Garske, factory representative; and H. Hicky, product engineer also of Carborundum Co.

The monthly executive board meeting of Tucson chapter was held at the home of Harry McClain. Front, from left are: Glenn Quillin, vice chairman; Ted Kresler, Cy Jacobson and Martin Bardach. Behind them are: Harry McClain; Strat Jones; Bob Pyers; Charles Green; and Bob Howard. Absent was Jim Beach, chapter chairman, who was pacing in a maternity ward, according to Joseph Vincent, editorial chairman of the Tucson chapter.

Burnham Finney Previews Metalworking

New York—"The metalworking industries will do a total business of more than $95 billion in 1954. That will be better than ten times the pre-World War II dollar volume. It means 1954 will be an exteremely good year in metalworking, if judged by any other standard than the super-boom of 1953," Burnham Finney, editor of American Machinist magazine, told an ASTE audience at the December meeting of the Greater New York chapter.

He said a high level of metalworking operation is insured by a number of favorable and important factors:

Armament manufacture will stay on a high plateau. Manufacture of planes, guns, guided missiles, communication devices and a host of military items will contribute substantially to metalworking production, despite some slackening from the 1953 pace.

Outlays for new plants and equipment, mostly from the later, promise to be as big in metalworking during 1954 as in 1953 and will be off only eight percent for the industry as a whole.

Makers of durable goods, including industrial machinery and heavy electrical products, will run at a very good rate, and in many cases at full capacity, throughout the year. Orders will show a declining trend, but production will be impressively high.

The electronics industry will be fully engaged. It will have a generous measure of defense projects, but beyond that television set manufacturers will enjoy big business.

The steel industry estimates that around 75 million tons of finished steel will be rolled and delivered to users in 1954. That compares with about 81 million tons in 1953, the all-time peak.

Charter Member Retires

O. L. Strand, charter member of the Saginaw Valley chapter, has retired as tool supervisor of Buick Motor Division, General Motors Corp. His position has been filled by another charter member of the Saginaw Valley chapter, L. A. Kitchen, also past chairman.

Cornell Staff Members Form Partnership

Charles F. Van Amber, member of the Elmira ASTE chapter, and Robert M. Matyas have formed a partnership to provide consulting services for the construction of nuclear devices. Both are staff members at the Laboratory of Nuclear Studies at Cornell University where they have supervised the construction of two large nuclear particle accelerators plus a number of other nuclear devices.

University Students Attend Waterloo Program

Ann Arbor, Mich.—The University of Michigan Student Chapter of ASTE held their first meeting of the fall semester with the Waterloo ASTE chapter. The program on the various uses of metal disintegration was presented by the Electro Arc Manufacturing Co.

At their November session, the student members visited the Argus Camera Co. to observe manufacture of high production precision parts. The machining of plastics, grinding of lenses, and testing of equipment provided the always interesting element of something new to the chapter. A film illustrated the necessary steps in setting up a production line in the plant. After the tour members were served coffee and donuts while they discussed points of interest with their guides.

King Seeley Corp. in Ann Arbor was the meeting place for the chapter's December program. Special emphasis was placed on time and motion study and quality control. The tour through the plant was followed by a lively discussion of the techniques observed.

The chapter's faculty advisor, Karl E. H. Moltrecht, has been elected an honorary faculty member of Vulcans, a senior engineering college activities honorary fraternity. He was chosen for his keen interest and assistance to the engineering students at U of M.

—*R. B. MacGregor*

Twin States Hears IBM Representative

Claremont, N. H.—The regular monthly meeting of Twin States chapter was attended by 79 members on December 9. Routine business included the awarding of pins to new members. A movie entitled "The Miracle of Felt," provided by the American Felt Co., preceded the technical portion of the meeting.

Featured speaker on the evening's program was N. Kenneth Perkins, project engineer, IBM Corp., Poughkeepsie, N. Y. In his talk, "Tooling of Small Precision Parts," special emphasis upon small watch and clock parts was made. Tolerances and inspection routines were revealed.

On November 11, members gathered at the Trade Winds Cafe in Springfield, Vermont. Guest speaker was Adam Gabriel, president, Acme Industrial Co., Chicago. His topic was "Micro Precision in Production."

—*Maurice E. Blais*

Coming MEETINGS

BUFFALO-NIAGARA FRONTIER—Feb. 11, University of Buffalo. Speaker Dr. Horace A. Frommelt of the Detroit Milling Cutter Co. Also election of officers.

CHAUTAUQUA-WARREN—Feb. 18, 6:30 p.m., Jamestown, N. Y. "Atomic Energy for the Layman" by Charles B. Moore, engineer, General Electric Co.

CEDAR RAPIDS—Feb. 17. A lecture and colored slides taken on a trip to the European Machine Tool Show by Fred Swanson, director of engineering, Sundstrand Machine Tool Co., assisted by Fred Kampmeier.

CINCINNATI—Feb. 9, 8:00 p.m., Engineering Society Headquarters. "New Concepts of Rigidity and Surface Foot Rates in Carbide Milling" by Dr. Horace A. Frommelt, consulting engineer, Detroit Milling Cutter Co., Detroit.

CLEVELAND—Feb. 12. "The Working of Stainless Steel" by Theodore R. Lichtenwalter, stainless steel field engineer, Central Alloy Div., Republic Steel Corp., Massilon, Ohio.

DETROIT—Feb. 4. Carbide section. "Latest Developments of Carbide Broaching" by representatives of Cincinnati Milling Machine Co. Feb. 11, Engineering Society Headquarters. "Electronics and Modern Production." Feb. 18. Education meeting originally scheduled, not to be held. Feb. 25. Plant tour of a tool and die shop.

FAIRFIELD COUNTY—Feb. 3. "Denison Multipress and How to Use It" by Francis Springer, district manager, Denison Engineering Co., Columbus, Ohio. Also special movie on the Ford Door Lock Assembly.

FORT WAYNE—Feb. 10. Election of officers—no technical session.

FOX RIVER VALLEY—Feb. 2, 6:30 p.m., Baker Hotel, St. Charles. "Making Good Tool Steel Perform Better" by A. J. Sheid, Jr., vice president in charge of metallurgy, Columbia Tool Steel, Chicago Heights, Ill.

GRAND RIVER VALLEY—Feb. 5, Moffat's Hall, Galt, Ont. Hamilton chapter members visit.

GREATER LANCASTER—Feb. 9, 6:45 p.m., Armstrong Floor Plant. "Armstrong Shell Tooling" by Robert Powl, chief engineer, Indiana plant, Armstrong Co., Lancaster, Pa.

INDIANAPOLIS—Feb. 4. Election night. "The Art of Generating and Gear Manufacturing Equipment" by John Thornton, sales engineer, Fellows Gear Shaper Co.

LIMA—Feb. 19, 6:30 p.m., Royal Pine Room. "The Forces in Single Point Tool Metal Cutting" by Eugene R. Wagner, supervisor, Westinghouse Electric, Lima, Ohio.

LITTLE RHODY—Feb. 4, 7:00 p.m., Johnson's Grill, Providence. "Plastics" by G. A. Ebelhare, manager, Synthane Corp., Oaks, Pa.

LONG ISLAND—Feb. 8, 8:30 p.m., Garden City Hotel, Garden City, L. I. "Salvaging Production Tools by Welding" by C. T. Williamson, district supervisor, Eutectic Welding Alloys Corp., Flushing, N. Y.

MID-HUDSON—Feb. 9. "Production Tooling Problems" by Harry Conn, chief engineer, Scully-Jones and Co., Chicago.

MILWAUKEE—Feb. 11, 6:30 p.m., Serb Memorial Hall. "Optical Gaging" by Edward Polidor, vice president, Optical Gaging Products, Inc., Rochester, N. Y.

NEW HAVEN—Feb. 11, Hotel Garde, "Carbides."

NEW ORLEANS—Feb. 12, 7:00 p.m., Tulane University. Election of officers.

NIAGARA DISTRICT—Feb. 4, 7:00 p.m., Barclay Hotel, Welland, Ont. "Material Procurement for the Orenda" by J. F. Taylor, manager of procurements, A. V. Roe, Malton, Ont.

NORTHERN MASSACHUSETTS—Feb. 16. "An Approach to Quality Control" by Simon Collier, director of quality control, Johns-Manville Corp., New York, N. Y.

PIEDMONT—Feb. 8, 6:30 p.m., Robert E. Lee Hotel, Winston-Salem, N. C. "New Standards for Carbide Turning" by George R. Morin, chief sales engineer, Jones & Lamson Machine Co., Springfield, Vt.

PITTSBURGH—Feb. 5, 6:30 p.m., Sheraton Hotel. "Next Ten Years for Tool Engineering" by J. L. Schwab, president, J. L. Schwab Co.

ROCKFORD—Feb. 11, 6:30 p.m., J. L. Clark Mfg. Co. Plant tour and dinner.

SAGINAW VALLEY—Feb. 18, 7:30 p.m., Cafeteria Buick V-8 Engine Plant No. 36, Flint. "Process Planning—The Buick V-8 Engine" by Roger E. Mitchell, general mechanic, Buick Motor Division, General Motors Corp., Flint, Mich.

TORONTO—Feb. 3, 6:30 p.m., Oak Room, Union Station, Toronto. "Milling Techniques and Practices" by a representative of Cincinnati Milling Machine Co., Cincinnati.

TWIN STATES—Feb. 10, Trade Winds Cafe. Executives' Night. "Materials Placement Controls; Its Effect on Manufacturing Costs and Output" by S. Saul, Jr., president, Rack Engineering & Mfg. Corp., Connellsville, Pa.

SPRINGFIELD, MASS.—Feb. 8, 7:30 p.m., Turnverein, Springfield. "Industrial Brushes" by Ralph Estus, sales representative, Fuller Brush Co., Hartford, Conn.

Harold E. Collins, center, national treasurer of ASTE, discusses plans for organizing an ASTE chapter at San Antonio, Tex. From left are: E. F. Measels, Jr.; O. G. Tobias; Mr. Collins; J. A. Metcalf; and H. P. Meadows. Several members of established Society chapters were on hand to participate in the meeting held at Alamo Iron Works, according to the report of Harry Betts, public relations chairman of the Houston chapter.

News in Metalworking . . .

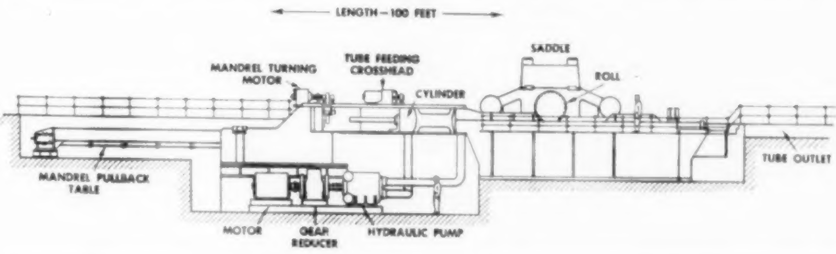
GIGANTIC COLD FINISHING MACHINE NEARS COMPLETION

A giant tube reducer is nearing completion for the Tube Reducing Corp. of Wallington, N. J., which will bring about considerable changes in the cold finishing process work. While 6½ inches OD has been the largest size that compression forming tube reducing machines could handle until recently, with this machine, tubes up to 18 inches OD can be handled.

The mammoth unit will be more than 100 feet long when completed. Its four principle sections include the roll housing section or saddle at one end, the tube feeding and turning equipment in the center, the drive, and the mandrel handling machinery. Sequence of these sections can be noted in the drawing at right.

Incorporated into the design of the design of the tube reducer is the feature of preloading the saddle frame, rolls and roll neck bearings to offset the calculated 3,500,000 lb separating force between the two rolls. Preloading consists of placing a compression preload to maintain the position of the reducing rolls up to the separating force.

When ready for operation, in April according to schedule, the unit will be used to produce precision seamless tubing ranging in size from 17 to 9 inches OD and in wall thickness as thin as 0.125 inch. Compression formed parts tubing, when used for such parts as large-sized ring shaped parts, cylinders, castings, and other items similar, is expected to eliminate need of the extensive machining required with heavier-wall cold drawn tubing or forgings.



BIG EQUIPMENT INDICATES PRODUCTION PACE AT NEW PLANT

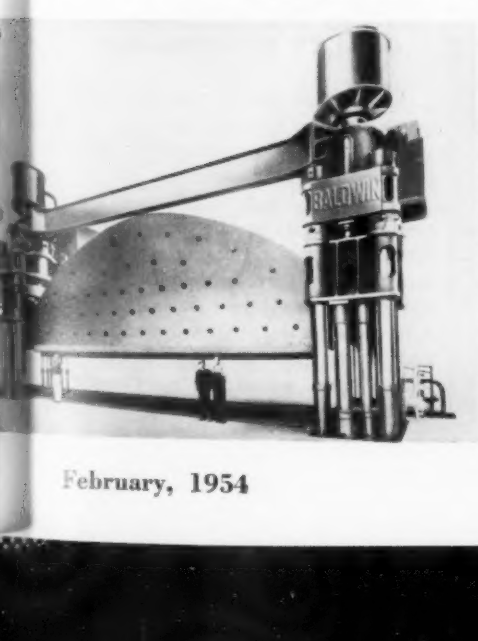
Full operations began with the new year at the new $5-million Foster Wheeler Corp. plant at Mountaintop, Pa. Equipped with the most up-to-date fabricating tools, the plant is turning out pressure vessels of varying proportions including some of the largest and heaviest now in demand.

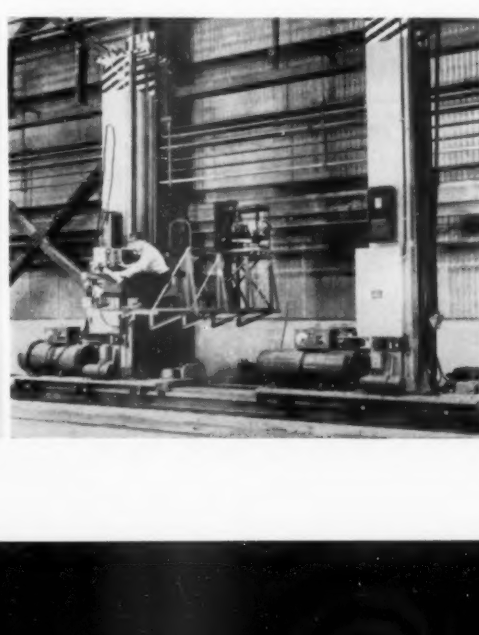
Three of the major tools which have been included in the equipment of the facility are shown below.

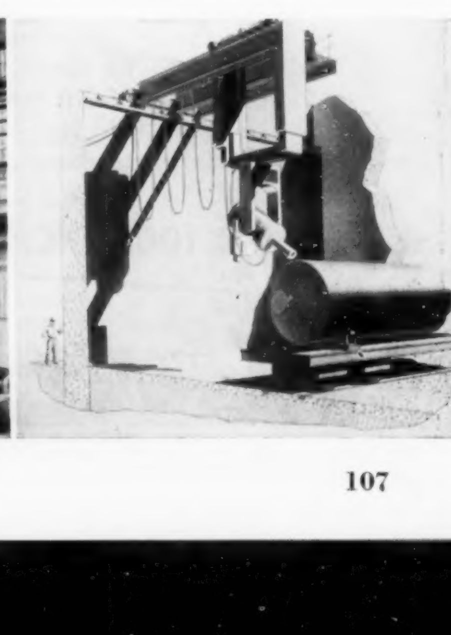
At left, an 8,000-ton hydraulically operated beam press weighing more than 3-million pounds, is capable of bending steel plate 8 inches thick. It may be used on either hot or cold plate. It is capable of bending plate eight inches thick and forty feet long into half-shells, which when welded together, will form pressure vessels of unusual proportions. Built by Baldwin-Lima-Hamilton Co., the press is one of the largest in the world.

In the photo at center, twin arc welding machines are utilized in a system of automatic shielded arc welding which can join an 8-inch thick plate at speeds considerably faster than in single wire welding units. These Lincoln welders are mounted on specially designed platforms traveling longitudinally on a 150-ft track which may be raised or lowered to accommodate work up to 12 ft in diameter. While the tool is basically similar to others now in use, its capacity and automatic features make it unique.

At right, the 2-million volt Van de Graaff X-ray generator is a particularly outstanding tool. Capable of penetrating steel 12-inches thick, the machine will photograph weld metal with such clarity of detail that minute flaws occurring in the metal will be exposed. The unit is the first such application of super-voltage X-ray in private industry. The drawing depicts how the crane supported generator will look in operation within its special building at the facility. Walls are reinforced concrete four feet thick.







OUT-OF-STEP MOTORS SOLVE VIBRATION PROBLEM

Solution to the problem of keeping compressors driven by synchronous motors out of step to prevent possibly disastrous vibration, is turned up by Westinghouse Corp. Their method of keeping a battery of reciprocating machines out of step is both simple and ingenious, and already has been applied to an installation of ten machines. Each motor in the setup is equipped with an extra slip ring which has a contact segment built into a small arc on its periphery. This slip ring, turning under a pair of brushes, closes a circuit with each motor revolution. A master reference, common to the ten motors, consists of a brush which is rotated at synchronous motor speed around a stationary commutator having ten evenly spaced contact segments, one for each motor. One side of a circuit, common to the ten units, enters through the brush and in one revolution makes contacts with each of the stationary contacts.

For operation, an idle motor is started, brought up to speed, and synchronized by leaving the compressor unloaded and the motor field weak. A set of relays then begins to reverse the motor field excitation and, with each reversal, the motor slips a pole. This process continues until the motor slip ring contact closes at exactly the same instant as that motor's indexing contact on the master reference. At that instant, a high speed relay closes to terminate the field reversing process and to increase the motor field current to normal; the relay also operates a signal to the operator that the compressor may be loaded.

The significant point is that all ten motors are adjusted so that their slip ring contacts close at approximately the same angular positions of the compressor crank for each machine. Since each motor's indexing contact on the master reference differs from that of every other motor, all ten compressor cranks are out of step with each other and station vibration is necessarily minimized.

TESTING MACHINE CHECKS QUALITY OF FORGINGS

The job of quality control testing of parts made by flash butt welding lengths of steel tubing to mating drop forgings has been greatly eased by the recent installation of a 1,000,000-lb hydraulic testing machine at The Cleveland Pneumatic Tool Co. The floor-type testing machine, built by Baldwin-Lima-Hamilton Corp., proof-tests flash butt welds with cross sectional areas up to 67 sq in. and having diameters up to 30 in.

The parts, which are components of large aircraft landing gears, are given

bending tests in four positions, using specially designed adjustable fixtures to hold the parts. For production testing, the fixture is used in one position for a series of tests of a group of parts, then it is reset for the succeeding test.

The testing machine is located adjacent to the machine shop where parts are finish machined after tests. The sensibite crosshead carries all loading and load measuring equipment, and there is no machinery under the floor. Automatic controls on the Baldwin-Tate-Emery control and indicator cabinet release the load when it reaches a predetermined maximum, or they hold the load for predetermined lengths of time. A foot switch connected into the control cabinet permits the operator to hold the gate into the test area closed during the time load is applied. Vertical space for compression tests is a maximum $15\frac{1}{2}$ ft, and for 14 ft for tension tests. Loads can be applied up to $3\frac{1}{2}$ inches per minute.

WORKSHOP ON WHEELS DEMONSTRATES ABRASIVES

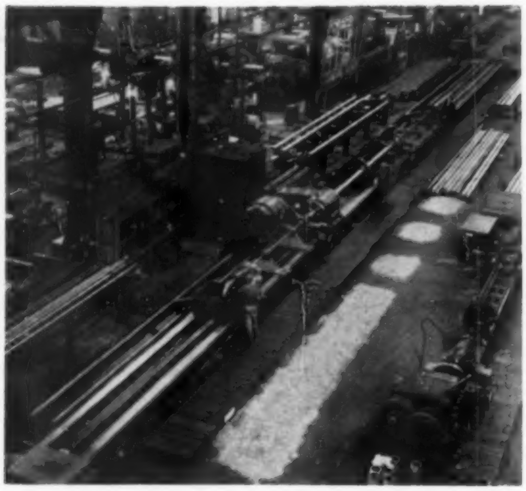
More and more the mobile truck or trailer is being utilized by industry to get across to the potential buyer the best picture of a product in use. Now the story of Carborundum's coated abrasive products is being carried to customers and prospective users throughout the country by the traveling workshop equipped to demonstrate this kind of grinding under actual production conditions. Still another point is that it will serve to keep industry abreast of the latest developments in the field.

The mobile selling unit, incorporated in a 35-foot vehicle, contains the means for showing the products in use and also how applications of them can benefit users specifically. The 19-ton workshop includes eight stationary coated abrasive rinding machines and a variety of portable tools to demonstrate actual production grinding operations. The selection is complete enough to cover the whole range of representative applications and potential uses for coated abrasives in the metals industry.

Particularly novel feature of the vehicle is its expanding sidewall which increases the effective width of the workshop to a total of 15 feet, when the unit is stationary, to provide seating capacity for an audience of some 12 to 15 people during demonstrations.

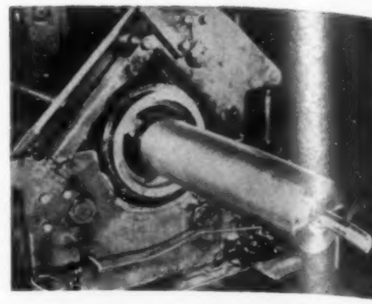
Company engineers conduct the demonstrations involving more than 20 grinding operations which are varied to fit the interest of the audience.

Experienced and specially trained engineer demonstrates operations and interprets adaptability to particular uses.



At left, overall view shows the 146-ft long double end boring lathe used in trepanning drill collars.

At right, a close-up view of the steady rest end of the lathe shows a bored collar with the core piece protruding from it.



DOUBLE BORING BRINGS ABOUT MULTIPLE SAVINGS

Only about a tenth of the time previously required to bore drill collars for oil field use is now needed due to a specially designed double boring lathe which uses the trepanning principle to accomplish the same work. With this design of operation, the cutting tools make an annular hole leaving a core piece of steel instead of removing all of the metal in the form of chips.

The time saving has become statistical fact since trepanning drill collars (steel lengths resembling drill pipe only with greater wall thickness) on a production basis for more than a year.

First work on trepanning at the Ambridge plant, Spang-Chalfant Div. of The National Supply Co., was started in 1948 on a converted lathe. From that time, experimentation led to the present unit which was designed and built by the Mesta Machine Co. in accordance with Ambridge engineers' specifications. The double end boring lathe is 146 ft. $6\frac{1}{2}$ in. long, on a platform 155 ft 3 in. Collars up to 55 feet long and up to 8 inches OD can be bored with this unit. Work ranges from about 4 to 8 inches OD and usually is 30 feet long, though as to capacity, the unit can bore collars up to 55 feet long and 8 inches in OD. Collars which have been bored range from 4 to 8 inches OD, and usually 30 feet long, although occasionally they range as much as 45 feet in length. Most common diameter bore diameters range from $2\frac{1}{4}$ to $3\frac{1}{2}$ inches.

At work, boring is done simultaneously from both ends. At each end, a trepanning head, which carries a $\frac{3}{4}$ inch wide carbide tipped cutting tool is attached to a nonrevolving drive tube or boring bar, which is held in the tail stock. During the boring operation, the workpiece, rather than the cutting head, is rotated.

Rate of penetration varies slightly from start to finish. At the beginning of the cut, when the tool is sharp, the rate is greater than at the finish of the cut when the tool naturally has dulled. In addition, such factors as hole size, spindle speed, type of tool, and hardness of the steel also affect the rate of penetration.

Coolant or cutting oil is fed under pressure through the space between the boring bar and the inside diameter of

the hole not only cools the cutting tool, but serves to remove chips as well. The coolant, with the chips, is discharged through the space between the inside diameter of the boring bar and the core.

A floor panel, located about mid-length of the machine controls spindle speed of the lathe. It also holds the starting and stopping switches for the coolant pump motors.

Since the collar is bored from both ends at the same time, two main control panels are necessary, one to serve each end of the lathe. These are placed at the tail stock where the boring bar is held. During trepanning operation, an operator is stationed at each of these panels where he can stop or start the main spindle and the motors which drive the feed screw, and also can control the rate of penetration through increase or decrease of the feed motor speeds. He can determine whether or not to change the rate of penetration, and also can tell when a tool is worn out, by observing the chips.

Still further savings are realized by using the removed steel cores in the machine shops for production of items requiring small diameter bar stock.

PROCESS SIMPLIFIES FORMING OPERATIONS

An unusual process and its equipment is attracting the attention of many visitors to Cincinnati Milling Machine Co.

In a single draw operation, the Hydroform presses blanks into shapes which usually require several draws by stamping. As a further interesting feature, tooling can be changed in a few minutes from one part to another. For example the Hydroform may be performing one operation, and within seven minutes, tooling may be changed, and the machine be producing a different part from a different metal.

The Hydroform is a cavity type, hydraulically operated ram and head machine, so designed that pressures up to 15000 psi can be controlled to press metal into or around a male tool.

There appear to be several types of work where this process may provide industry with economic advantages, including the benefit of less expensive tooling, possibility of producing more complex shapes in fewer operations, and the ability to produce parts in small quantities for research and experimental work.

CORRECTION

In the January issue of THE TOOL ENGINEER, The Thompson Grinder Co. of Springfield, Ohio, should have been credited with installation of the world's largest surface grinder at Monarch Machine Tool Co. plant.

Tools of Today . . . .

Tube Bender

Bends varying from $\frac{3}{4}$-in. to 2-ft radius in finned or plain ferrous and nonferrous metal tubing up to 40-ft long are possible with the semiautomatic hydraulic powered machine recently added to their line of tube bending machines by Walter P. Hill, Inc., 22183 Telegraph Rd., Detroit 19, Mich.

With this machine, tubing up to $1\frac{1}{2}$-in. diam is bent around a cone-shaped steel die that is adjustable, both vertically and horizontally, to provide bending radii in infinitely variable increments within the large and small diameters of the cone. Larger bend radii are attained by nesting hardwood cones of larger sizes over the conical steel die. Four hardwood cones provide the radius range up to 2 feet, for example.

The bending table is powered by a high torque, positive displacement, single vane, one revolution hydraulic motor. Smooth action of this hydraulic drive enables the new machine to bend finned or plain copper tubing on an 11-in. diam without annealing.

Because all machine adjustments can be made quickly through hydraulic controls, it is adaptable to both job shop and semimass production bending operations on a wide variety of lengths and sizes of metal tubing.

To bend a length of tubing to a desired radius, the proper bending die vertical and horizontal locations are set with hydraulic controls. Then the clamping die assembly is positioned on the bending table in correct relationship to the bending die.

With the machine thus set up, a length of tubing is inserted to correct depth in the long tubular holder. A wiper die is hydraulically advanced to contact the bending die and the tubing is simultaneously clamped hydraulically in the clamping die.

The bending cycle is then initiated and bending table rotates 180 degrees, thus bending the tubing around the bending die which rotates with the table. The clamp and wiper dies then open, the bent tubing is removed, and the bending table is returned to starting position for another bend.

Bending table travel is adjustable to permit overbending and counteract tube springback problems. Bend radius adjustments as small as 0.001 in. can be made in a matter of seconds on the machine.

A mandrel, over which the tubing is slid in the holder to avoid tube collapse problems, is only required on the Hill bender on bends below 1-in. radius.

Three manually operated hydraulic valves control all adjustments and the bending cycle.

The machine of welded construction throughout, is 16-ft long, 7-ft wide and $4\frac{3}{4}$-ft. high. **T-2-1121**

Tracer Tool

Air Control Div. of Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa., has designed the Model M 1500 profile tracing tool as a simple, compact and inexpensive precision duplicating attachment adaptable to medium size lathes such as those in the 16 to 24-inch size range. All mechanical, it has no complicated electronic or hydraulic mechanisms.

Installation is quick and simple, since the lathe compound is removed

and the tracer tool is mounted directly on the cross slide.

This tracer tool has a horizontal slide operating between two rows of $\frac{3}{8}$-in. preloaded ball bearings, thus eliminating all slap and side play. Air pressure, applied to the tool through a pressure regulator and a four-way valve assures positive contact between the stylus and a $\frac{1}{4}$-inch templet. Shop line air pressure is sufficient.

A rotary stylus with positive wedge lock is an added feature of this tool for high production duplicating work. This permits the cross feed screw to be set in one position and not moved while successive production pieces are machined. This is especially desirable on lathes which are slightly worn or those in which it is difficult to move the cross slide and then return it to its exact original position. The tee slot on top of the tracer tool slide will accept either a standard tool post, a square turret, or a quick-change toolholder. On production work, either the turret

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or th[e q]uick-change toolholder is preferred because they permit separate tools [for] roughing and finishing.

S[ince] there is nothing on the front of the slide except the tool and its holder, there is excellent working visibility and ample clearance for the chips or t[urn]ings coming off the work.

O[ne t]est runs the Lehigh Tracer tool took [ ]-in. cuts on Nitralloy bars with 0.03[ ] inch feed. The stroke of the tool is 4 inches permitting diameter changes of 8 inches to be turned. It is possible to turn 90-degree shoulders either externally or internally in the direction of feed. Internal or external threading, straight or tapered, can be made with a single pointed tool. Facing is done by rotating the tracer tool so that it is perpendicular to the cross slide. Contours of various types can be turned as can blended radii of any amount. Because the tool retraction is air-operated, threads can be cut right up to a shoulder without danger of tool breakage.

T-2-1122

Hydraulic Vise

The American Tooling Corp., 60 E. 42nd St., New York, N. Y., announces a self-contained hydraulic vise, known as the Hilma-Hydrovise. This high-precision unit has no pump, hoses, tubes, or connections to interfere with its use, and combines the elements of a mechanical vise with those of hydraulic power transmission. When the vise handle is turned clockwise, the jaws close mechanically until the clamped object is encountered. At that point, a clutch automatically is activated and additional force is applied hydraulically.

Up to 8,750 lb can be applied almost with finger-tip control, pointing up the major advantage of this self-contained unit. Once the hydraulic system goes into operation, the movable jaw will advance only $\frac{1}{32}$ of an inch.

Work is clamped safely avoiding vibration and chattering, permitting higher machine-tool speeds, prolonging cutting-tool life, and insuring close-tolerance machining. The hydraulic action maintains pressure even if work

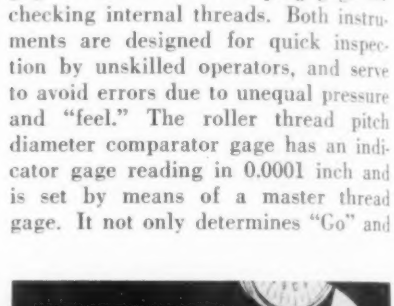
gives after being clamped in position. The vise is so designed that the work is forced down when clamped; it cannot rise as the vise is tightened.

An additional advantage is the ease with which the vise is transported from one machine tool to another without danger of damaging elements of the hydraulic system. The Hydrovise already is being used on shapers, surface grinders, milling machines, planers, presses, and other machine tools.

T-2-1131

Thread Gages

Announcement of a line of indicating thread gages has been made by the George Scherr Co., 200 Lafayette St., New York 12, N. Y. Included is a roller thread pitch diameter comparator gage and a dial thread plug gage for checking internal threads. Both instruments are designed for quick inspection by unskilled operators, and serve to avoid errors due to unequal pressure and "feel." The roller thread pitch diameter comparator gage has an indicator gage reading in 0.0001 inch and is set by means of a master thread gage. It not only determines "Go" and



Above, inset shows details of plug gage through cross section drawing.

Below, roll thread pitch diameter comparator gage is in use.

"Not Go" tolerances, but also its position within the tolerance field, detecting the right time when a threading tool must be renewed, and sorting the work into classes of accuracy. Out-of-round errors are discovered simply by turning the work around between the measuring rollers. The measuring range is up to 2-inch thread diameter. A special pair of rolls is needed for every type of thread and lead.

The dial thread plug gage measures internal threads quickly by means of three interchangeable measuring jaws, of which the middle one is retractable between the other two. The jaws are first inserted in a ring gage and the indicator set to zero, then used on the work and variations quickly observed on a dial, which was previously set to prescribed tolerances by two adjustable tolerances hands. The instrument comes in three sizes for ranges of thread diameters $\frac{3}{16}$ to 1 inch, 1 $\frac{1}{16}$ to 2 $\frac{1}{16}$ inches and $2\frac{1}{8}$ to $4\frac{3}{4}$ inches. A separate set of measuring jaws is necessary for every size and type of internal thread.

These gages can also be used for checking smooth cylindrical work and smooth bores, with special measuring rollers and measuring jaws. **T-2-1141**

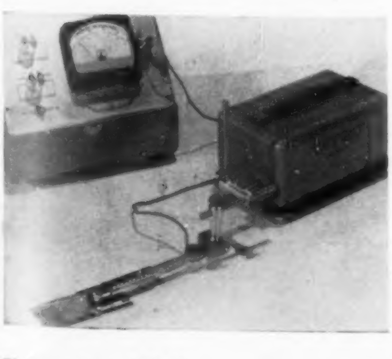
USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Motor Drive

Brush Electronics Co. announces the availability of a mechanical tracing accessory for use with the Surfindicator, an instrument which measures surface roughness.

The Brush Motor drive, Model BL-114, provides mechanical movement of the Surfindicator pickup along a surface being inspected, and is designed for special applications which extend the usefulness of the basic Surfindicator beyond the range that is practical with hand operation.

The length of its reciprocating stroke is adjustable from $2\frac{7}{8}$ to less than $\frac{1}{16}$ inch, allowing for an extremely wide



range of measurements. Stroke speed is ⅛ ips.

Instantaneous reversal, constant speed, and low vibration level of the unit insure surface roughness measurements of the highest possible accuracy.

The unit is suggested for use on large quantity inspection of similar parts, and where very fine finishes and high accuracy are essential or wheel operation is confined to very small areas.

A detailed description of the motor drive may be obtained from company's Equipment Div. SP, 3405 Perkins Ave., Cleveland 14, Ohio. **T-2-115**

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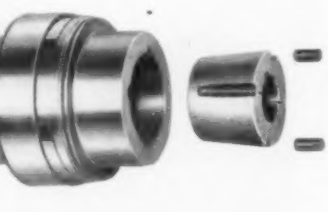
C Couplings

Three sizes of a Lovejoy type C couplings series, adapted for use with Dodge taper-lock bushings are being made available to industry by Lovejoy Flexible Coupling Co., 4998 W. Lake St., Chicago, Ill.

They permit easy fastening to shafting with the firmness of a shrunk-on fit, thus making it possible for distributors to carry a smaller number of coupling bodies taper-bored for taper-lock bushings.



The three sizes included in the series are: C-191 (Dodge bushing No. 2012) for bores ½ to 2 inches; C-228 and C-276 (Dodye bushing No. 2517) for ½ to 2½-inch bores. **T-2-1160**

Clamps

Two types of midget sized clamps are announced by Lapeer Mfg. Co., Lapeer, Mich. Though small, they provide surprising strength. Model V-100, with vertical handle and horizontal mounting surface, has a clamping force of 100 lb with spindle located at end of toggle bar. Model S-100 is for side mounting and also has a clamping force of 100 lb when spindle is at end of toggle bar.

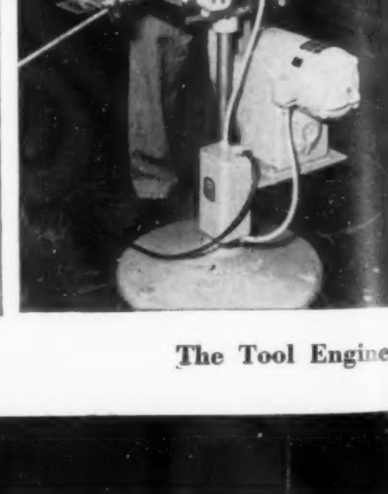
The company will send templets of either model in full, half or quarter size, on request. **T-2-1161**

Straightener

A light-duty, power-driven straightener has been introduced by U. S. Tool Co., Inc., Ampere (East Orange) N. J. These models are arranged with a variable speed drive unit, which makes it a simple matter to control the output speed to conform to the requirements of the job.

The power-driven straightener, called Model RS-67, is suitable for material up to 6 inches in width and ⅛ inch maximum in cold roll steel.

Specifications include a pair of power-driven taken-in rolls, 7 plain straightening rolls, a pair of power-



...n take-out rolls, 5 to 1 ratio variable speed drive, output 10 to 50 feet per minute, mercury switch loop control arrangement and ½-hp motor for operation on 220/440 volts, 3-phase, 60 cycles AC.

The mercury switch loop control arrangement maintains a loop of material between the straightener and the press or machine with which it is used. The straightener can also be employed for material which comes in strip form.

The same type of unit is also made in 10 and 12-inch capacity. **T-2-1162**

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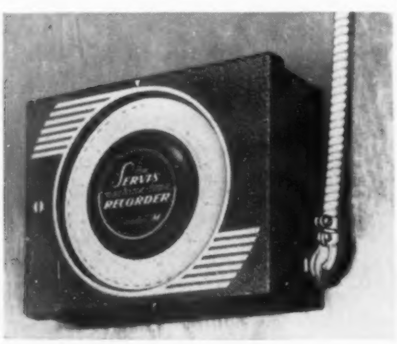
Machine Time Recorder

To provide an immediately visible record of the busy and idle time of plant machinery, Model "M" Servis recorder has just been introduced by The Service Recorder Co., 1375 Euclid Ave., Cleveland 15, Ohio. The unit may be used to improve machine productivity, as well as provide data for time studies to set rates, or as a check on the exactness of processing operations.

Because it requires only a wire connection to the machine's motor, the Servis recorder can be located anywhere—on an office wall, for example. The recording can be seen as the machine operates; a sapphire stylus marks on a wax-covered chart. To prevent unauthorized opening of the recorder, the chart shows whenever the case was locked or unlocked. The standard 6-inch diameter, 24-hour chart will revolve 3 times, making a total record of 3 days and 3 nights on a single chart. 12-hour and 8-hour charts are also available. If desired, an elapsed timer or counter is included in the recorder.



Model "M" folder, available from the company, describes the Servis recorder in detail and includes data on various electrical hookups. **T-2-1171**

Optical Comparator

An unusually designed precision optical comparator, known as the Model R-300 has been announced by the Portman Instrument Co., Inc., Town Dock Rd., New Rochelle, N. Y.

It incorporates the "Multi-Phase" optical system which projects an upright properly oriented image with definition and screen brightness. The system offers the advantages of long focal lengths at every magnification providing large working space clearance between the lenses and the object stage platform. An indexing type lens mounting capstan is also available making it possible to instantly change from one magnification to another by a simple conveniently placed lever control.

Lenses to provide magnifications of 10, 20, 25, 31¼, 40, 50, 62½ and 100X are obtainable as standard equipment.

Either a plain platform type stage, or a universal coordinate measuring

stage may be used.

The high-powered light source has a variable volume control, is blower cooled, and provides completely uniform illumination over the entire 16-inch diameter screen area. The light housing is also equipped to use a three position turret mounted color filter holder attachment.

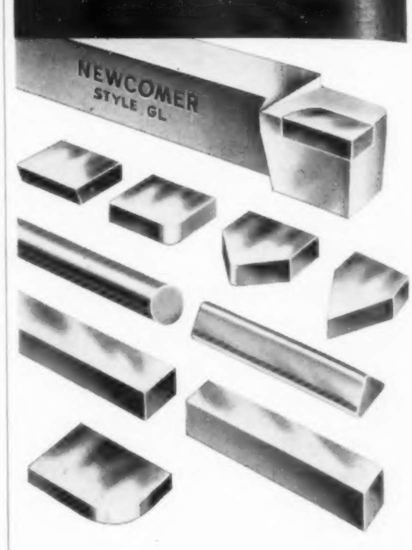
Various accessories available include a spring plunger V-type center stage, graduated rotary screen with vernier scale, and dual lens high intensity surface illuminator attachment. **T-2-1172**

Spring Coiler

A hand-operated spring coiling machine for use in toolrooms and small machine shops for making prototypes and small production runs up to 1000 compression, extension and torsion springs, has been redesigned and uses aluminum castings and a ball-bearing carriage to increase accuracy and simplify opertion.

A main advantage of the unit is that inexperienced operators can easily coil compression springs to any desired pitch with the coils at both ends squared automatically. Extension springs can be wound with or without initial tension and torsion springs can be wound either left- or right-hand with long extended arms on both ends.

Extension or torsion springs from 250 to 400 compression or 200 to 300 can be identically coiled per hour. Wire diameters can vary from 0.004 to 0.065 inch and spring diameters from 1/32 to 1¼ in. with lengths up to 4½ in. Arbors, wire cutters and extra coiling points are included. Shipping weight 50 lb. Descriptive literature is available from The Carlson Co., 277 Broadway, New York 7, N. Y. **T-2-1181**



Punch Press

An 18-station rotary turret punch press that punches any shape hole is announced by Rotex Punch Co., Inc., 23[illegible] Alvarado, San Leandro, Calif. The desired punch-and-die set is brought into position instantly by a rapid, manual turn of the turret and locks into place with perfect alignment. Punch-and-die sets can be made to designs or are available in scores of round or irregular shapes and sizes up to 2 inches in diameter. Punches metals, plastics, cardboard, fiberboard, leather and other sheet material.

An illustrated brochure on this unit is available from manufacturer.

T-2-1191

Syncrogear Motor

For locations where dangerous fumes, inflammable gases, explosive substances or combustible dusts may exist, U. S. Electrical Motors Inc., Box 2058 Terminal Annex, Los Angeles 54, Calif., has announced its right-angle Syncrogear with explosion-proof motor. Available in 1 hp rating with speeds from 45 to 155 rpm, this 3-phase a-c motor, known under this manufacturer's designation as Type SESV-GW, is designed to comply with Underwriter's specifications for Class I - Group D, and Class II -

Groups F and G service.

It incorporates a cantilever design to protect gear alignment. Mounting stresses are absorbed by the one-piece base, freeing the gear and motor housing of distortion. Type SESV-G embodies splash lubrication, a hardened and ground worm, normalized castings and asbestos-protected windings.

Other right-angle units of the line include a combination Varidrive-Syncrogear motor for variable speeds, a footless type Syncrogear motor for direct connection to driven machine and a single-phase Syncrogear motor equipped with capacitor.

Right-angle Syncrogears are available from $\frac{1}{4}$ to 3 hp with speeds of 20 to 155 rpm and ratios up to 58:1. For detailed literature concerning these motors write to the company. **T-2-1192**

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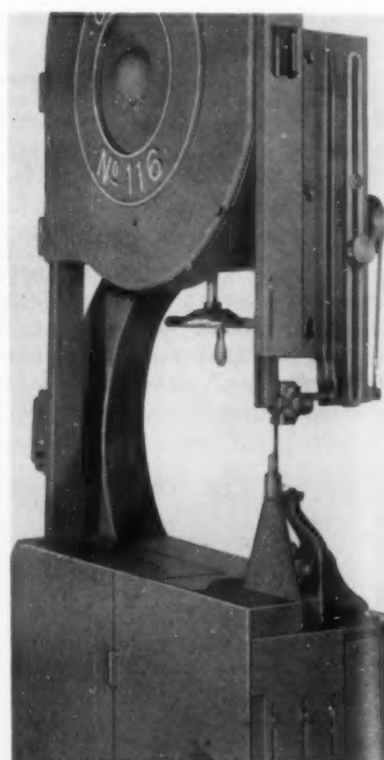
Trim Saw

This special trim saw for aluminum press formed parts has been placed on the market by Oliver Machinery Co., Grand Rapids 2, Mich. It is designed for quick trimming of the wrinkled edge of stressed material frequently formed around the outside of aluminum and thin steel parts which have been



performed. The cutting is accomplished on the Oliver No. 116-T trim saw by merely placing the work on top of the Micarta guide pin which acts as a supporting point. The ample clearance around this point permits unrestricted angling and turning of the material during the cutting and trimming operation. A fine-tooth blade operated by 5-hp motor at 720 rpm will produce a rapid and clean cut. For cutting of sheet metal or stainless steel a 5 hp, 900 rpm motor is recommended. The machine can also be equipped with a variable speed motor drive up to a 6:1 ratio with maximum speed variation from 1200 rpm to 200 rpm.

T-2-1201

Granite Straight Edges

A line of commercially accurate black granite straight edges in lengths up to 72 inches has been developed to supplement the precision straight edges manufactured by Collins Microflat Co., 2326 E. 8th St., Los Angeles, Calif.

Surface of these new straight edges are finished to an accuracy of 0.0002 inches per foot, whereas surfaces of Microflat super precision straight edges are finished down to 50 millionths overall. However, they have the same advantages as the regular line of precision straight edges in that they are nonwarping, nondeflecting, easily washable, extremely smooth, temperature inert, rigid overall and moisture repellent.

The ends are tapered and fitted with leather grips for easy, secure handling.

T-2-1211

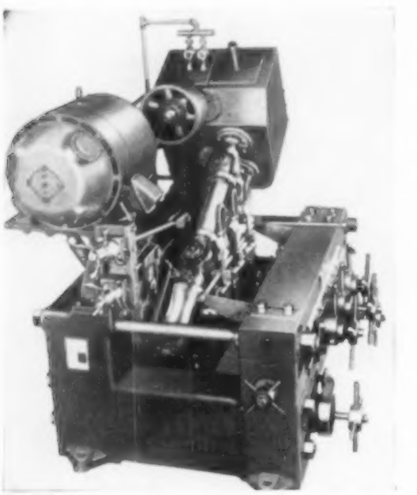
Heavy-Duty Straightener

A special feature of the heavy-duty straightener for hot-rolled bars and heavy-walled tubes, recently offered by the Sutton Engineering Co., Bellefonte, Pa., is a water cooling system which makes possible the handling of special alloy bars at elevated temperatures.

Listed as the 1½ BC, the unit is equally adaptable for steel or nonferrous tubes and round bars such as heavy-walled seamless tubing or alloy heat-treated hot-rolled bars, and has a straightening speed ranging to 400 fpm.

The unit handles tubes from $\frac{5}{16}$ to 3-inch OD, and bars from $\frac{5}{16}$ to 2-inch diam at low straightening cost. The Sutton 5-roll principle distributes the straightening loads over three points; unit pressures are reduced and maintenance is minimized.

The design is engineered for long roll life. A central pressure roll is



located between two sets of opposed rolls, each set having one opposed driven roll and one idler roll. Because only one roll of each pair of cross rolls is driven, roll diameters need not be matched and wear is reduced. Anti-friction bearings are used throughout the rugged construction.

The 5-roll principle employed in the design furnishes an additional benefit to plant floor efficiency as the roll arrangement permits easy scale disposal. Straightening rolls are placed in a horizontal plane and mill scale falls readily into a disposal pit.

Compactly designed, the unit occupies a space only 10 feet long by 8 feet wide and 8 feet high, including the drive. **T-2-1212**

Internal Comparator

The Portage Double Quick Tool Co., 1054 Sweitzer Ave., Akron, Ohio, announces the new "Interapid" internal comparator. The gage has capacity for gaging diameters from 3/8 to 6 inches. The adjustment of the instrument is made by turning the knob in the center of the gage.

Initial setting of the gage is made with gage blocks, master gage rings or micrometers. A small locking lever is provided for retracting the arms so tips may more easily enter the work being checked. Comparative reading on the meter-type scale, graduated in 0.0005 in., shows at a glance whether the holes are over or undersize and by exactly how much. Even diameter of very shallow counterbores may be checked since measuring tips are at the extreme end of the arms.

For checking larger diameters, the set includes two sizes of centering arms which snap on and off readily.

T-2-1221

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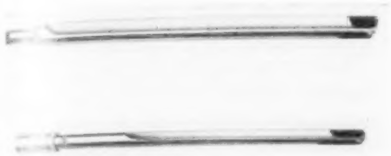
Gun Drills

Carbide tipped gun drills, designed to produce round, straight and deep holes, have been placed on the market by Whitman & Barnes, Plymouth, Mich. Two types are offered: solid high-speed body and oil tube body types. The former is used successfully when the hole is comparatively shallow; the latter is used when the hole to be drilled is very deep. In both cases, oil under pressure is used to cool the cutting lip and force the chips out of the hole.

It is practical to revolve either the drill, or the workpiece. In some instances, it is reasonable to revolve both. Oil can be forced through the end of



the shank or the side, depending upon the machine in use.

These drills can be used in vertical or horizontal positions. Application can be singular or multiple, depending upon the setup in the machine. In extreme over-all lengths, a great amount of care must be given to maintain constant oil pressure, which in turn serves to maintain the rigidity and the accuracy of the drill and its performance.

T-2-1222

Refractory Gun

Vibron Div. of the Burgess-Sterbentz Corp., 3790 W. 150th St., Cleveland 11, Ohio, has introduced a compact pneumatic refractory gun designed to reduce the cost of many time-consuming hand-applied refractory jobs in small ladles and other confined places.

With this gun it is possible to apply refractories with 40 to 50 percent less moisture and thus produce longer-lasting refractory linings or patches, as well as reduce lining shrinkage and drying time and increase operating life of equipment.

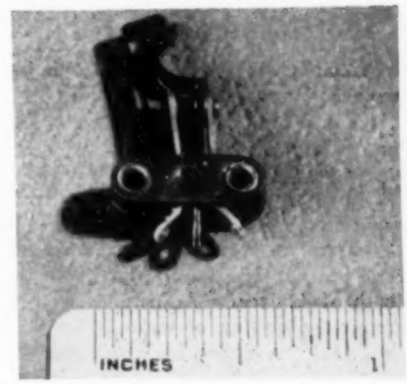
Compressed air introduced alternately to the opposite ends of the cylinder causes a piston to reciprocate in a cylindrical passage, resulting in a powerful high frequency stroke.

Weight of the Vibron Bantam is only five pounds. Fast and easy to use, it operates at greatest efficiency between 85 and 130 psi. The small head is useful for initial sewing or ramming while the larger molding head is used to apply a superior finish to the refractory. The gun comes equipped with a 10-foot flexible air hose and quick connect swivel coupling. **T-2-1231**

Midget Switch

Developed originally for a relatively high teperature and humidity application, the midget precision snap-action switch made by Acro-Mu Switch Div. of The Acro Mfg. Co., Columbus, Ohio, is especially adaptable for use in electronic devices as well as in appliances and business machines. It has a two-piece, ½-inch long base molded of Melmac 1500 plastic, which has high arc resistance, excellent dielectric strength, low specific gravity, and is molded easily.

The switch is known as M-OM, or Midget open blade Model M. It is a single pole, double-throw switch with the following operating characteristics: 0.010 - 0.015-inch contact gap; 3 - 6-oz operating force; 1½-oz minimum release force; approximately 0.020-inch movement differential. It is rated at 3 amps 115 volts AC. **T-2-1232**



Metalworking Machine

Primarily designed for general maintenance department work where sheet metal must be cut to many sizes and shapes, and formed by beading, folding, dishing or louvering, the Model P-5 works mild steel up to $\frac{7}{32}$-inch capacity. This unit, introduced by American Pullmax Co., Inc., 2455 N. Sheffield, Chicago 14, Ill., has a throat depth of 42 inches. Adjustable centers permit the cutting of various size circles, while an adjustable guide aids in making straight cuts or square holes.

Because of its movable upper tool, this unit will cut inside or outside work by means of a reciprocating action that leaves an edge which requires no further finishing.

Other models of the Pullmax machine range from the smallest Model AM with 16-gage capacity, to the giant Pullmax Major 2 with a capacity of 11/32 inch. **T-2-1241**

Lubrication

Multi-purpose E.P. lubricating grease, known as Molykote type BR2, for highly loaded ball and roller bearings and heavily loaded sliding friction surfaces, has been announced by The Alpha Corp., Greenwich, Conn.

The compound is an oxidation-inhibited, lithium-base product, fortified for E. P. characteristics with Molykote Type Z, the purest molybdenum disulphide powder available.

The lubricant has an operating range from –30 to 350 F. Additional information concerning physical and chemical properties, as well as application data, is available from The Alpha Corp.

T-2-1242

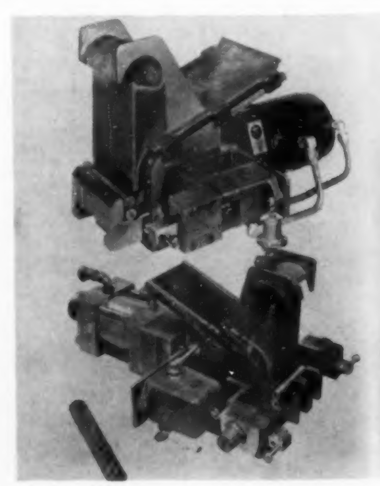
Loaders for Broaching

Red Ring automatic loaders for single ram vertical surface broaching machines have been announced by National Broach & Machine Co., 5600 St. Jean, Detroit 13, Mich. These loaders are particularly adapted to the handling of round parts on which flats, slots or ends are broached in single ram machines.

Magazine feed arrangements work in conjunction with a hydraulic cylinder powered load and unload mechanism. The 1,000-psi hydraulic control cylinder is flange mounted at the rear of the loaders and is operated by an air booster.

In the illustration, the loader at the bottom positions two $\frac{7}{8}$-in. dia, 6-in. long automotive automatic transmission control rods in front of a broach on a single ram vertical machine where two slots and one end are finished by the broaching process.

Parts are loaded on the magazine between side rails. With the vise jaws retracted, two parts drop into position, one above the other in the jaws. The



jaws are pushed forward against a stop by the cylinder, and the air booster applies high clamping pressure.

The resulting pressure buildup in the hydraulic cylinder causes a sequence valve to initiate the broaching machine ram downstroke, broaching two flats and the end of each part simultaneously. When the ram reaches the bottom of the stroke, high clamping pressure is released and the ram returns to the top of the stroke.

Two unloading dogs on the top of the broach holder grip the two parts and carry them up out of the vise jaws. A curved chute at the top of the loader picks off the parts which then slide out on an angular chute into a container. When the finished work is lifted clear of the vise, the vise retracts in position to receive two more pieces from the feed magazine.

The units are made in a variety of sizes to meet specific application requirements. The loaders are designed to operate in conjunction with individually designed broach holders. The fixture described permits a broaching production of 650 transmission control rods per hour. **T-2-1243**

Feeler Gages

A complete line of feeler (thickness) gages including individual blades is announced by the Klopp Engineering Inc., 35551 Schoolcraft, Linovia, Mich. Known as the master tool, the line is precision made of the finest quality Swedish steel with etched-on thickness numbers. A lock nut permits the removal of individual blades. All blades are guaranteed for accuracy.

T-2-1251

Improved Screw Points

The Allen Mfg. Co., 113 Sheldon St., Hartford, Conn., announces two improved types of point, one applied to set screws and the other to cap screws.

A smaller cup point for set screws, called the Allenpoint, will replace A.S.A. cup point set screws in the standard Allen line.

Tested by the United States Testing Laboratory comparatively with standard cup point set screws and screws with angled and serrated points, the point demonstrated great locking at all measured installations vs. removal torque pressures, uniformly high shaft holding power in torque resistance tests, excellent performance under vibration and more complete shaft contact pattern.

This set screw is available through

Industrial Distributors, in Allenoy and stainless steel, with either NC or NF threads.

An unthreaded leader point has been developed for Allen cap screws, designed to reduce substantially the cause of screw thread injury and damage to threaded holes. Purpose of this item is to improve line-up, particularly in inaccessible spots, and protect against damage resulting from dropping or knocking against other metal surfaces. It will be a standard Allen cap screw feature. T-2-1252

Tool Holder

An unusually designed vertical toolholder, recently announced by the Vascoloy-Ramet Corp., Waukegan, Ill., includes among its special features a "built-in" carbide chipbreaker, which provides correct chip formation over wide cutting range for single chipbreaker results in lower chip pressure and therefore reduces horsepower, tool wear and heat.

Further, the method by which the carbide insert is held by the V-R toolholder permits all of the carbide insert to be used. To sharpen the inserts all that is necessary is to surface grind the ends of the insert.

The tool implies foolproof setup because it gives positive automatic positioning of the cutting edge in the vertical as well as horizontal plane. All adjustment, location and clamping of the insert is done by one screw on top of the toolholder. There is a socket provided at the bottom end of this screw for convenience in upside-down (backmounted) applications. These toolholders are now available in 30 different styles and sizes with additional styles and sizes to be added in the near future. T-2-1261

USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Koldwelding Tool

Lap welding of aluminum sheet or foil without heat or electricity and without flux or chemical of any kind may be done with the Koldwelding tool made by Utica Drop Forge & Tool Corp., 2500 Whitesboro, Utica, N. Y.

First of a series, the tool, identified as Model No. KL-10, for aluminum sheet, is now ready for distribution after several months of testing. It is expected that a corresponding tool for the butt welding of aluminum and copper wire will follow shortly.

The tool is hand operated and accomplishes the welding of aluminum foil, sheet, shaped extrusions or strip by pressing the surfaces of the parts together between specially designed dies. To prepare the metal surfaces for the weld it is merely necessary to clean them with a steel wire scratch brush (or similar mechanical action) to remove surface oxidation, dirt and grease.

It will Koldweld aluminum and elec-

trical copper in thicknesses 0.001-0.040, or an over-all maximum thickness of 0.080. Dissimilar sizes or different metals also may be welded. Each thickness of material requires a different size interchangeable die. The KL-10 handles all types of aluminum (except 56S and aircraft qualities in the T temper) and electrical copper.

Welds accomplished by the No. KL-10 meet the same tests as applied to conventional welds, and it is found that when the weld is pulled apart fracture occurs around the periphery of the spot, pulling a slug from one of the sheets.

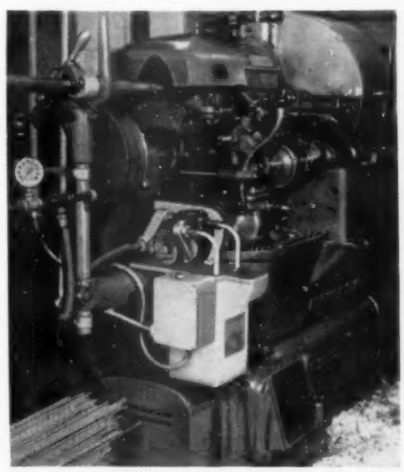
T-2-1262

Screw Machine Feed

According to user plant records, substantial rate increases under production conditions are being obtained through use of a low-cost attachment for feeding screw machine stock, developed by Aurora Precision Devices, Inc., 318 Anderson Blvd., Geneva, Ill.

Known as Hydra-Lite, the attachment speeds stock handling and also reduces many subsequent operations because the hydraulic feeding eliminates feed fingers which often score bars.

Still further saving in time is made because of the exclusive signal light



which turns on automatically as the bar end approaches, enabling the operator to be ready with a new bar without interval delays.

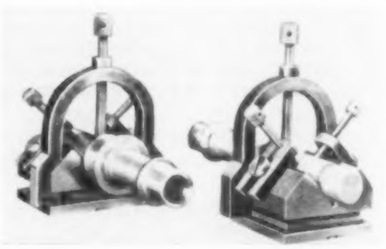
The feed is a hydraulic, self-contained, independent unit. Each unit is equipped with its own hydraulic pump and has its own supply of oil for the feed, thus eliminating troublesome filters, clogging of collets, or use of improper cutting oils.

Hydra-Lite models are available for all No. 00, 0 and 2 Brown & Sharpe machines and feed stock from 1/16 of an inch to $1\frac{1}{8}$ inches in diameter. The average job requires only 20 pounds

of oil pressure, supplied by the self-contained pump. This pressure will feed piece lengths up to three inches and the pressure can easily be adjusted to feed up to five-inch piece lengths. Under the heavier pressures, necessary to feed large bars, a metering valve is provided on the No. 2 feed to automatically control feet per minute of bar travel, eliminating excessive shock and possible damage on turret parts. On all feed sizes, constant pressures are maintained throughout feed, regardless of length of bar stock. **T-2-1271**

V-Blocks

Tools for dimensional quality control, designed and manufactured by Precision Tool & Manufacturing Co., 1305 S. Laramie Ave., Cicero 50, Ill., now include a line of Uni-V-Blocks. Made of forged chrome moly, these accessories, which are available in matched pairs, are guaranteed to be



square and parallel and concentric to each other to a tolerance of 0.0002. Heat treated and hardened clamps are provided with each pair.

Three models offered include the 1250, with dimensions of $1\frac{1}{4}$ x $1\frac{1}{4}$ x $1\frac{5}{8}$ in.; the 3000, with dimensions of $2\frac{7}{32}$ x $3\frac{3}{4}$ x $2\frac{5}{16}$ in.; and the 5000 with dimensions of $4\frac{3}{16}$ x $5\frac{1}{8}$ x $5\frac{3}{8}$ in.

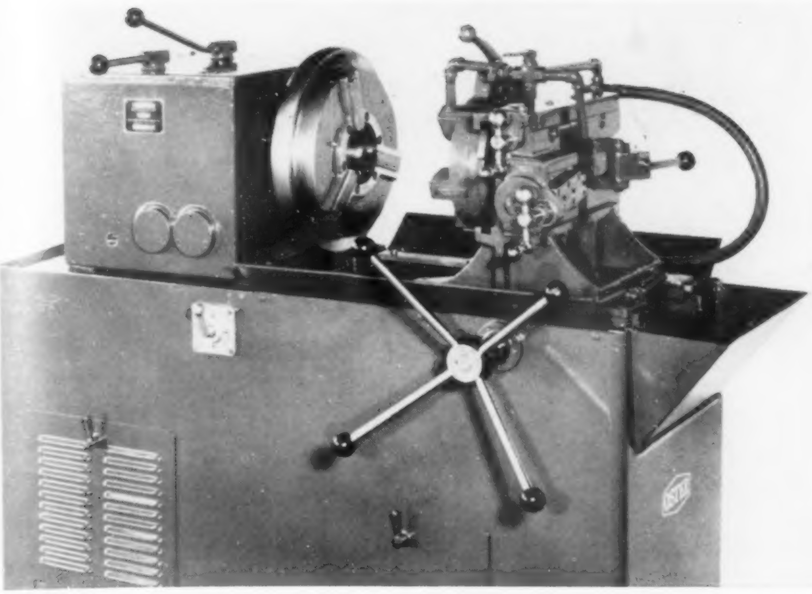
T-2-1281

Pipe Machine

The Oster Mfg. Co., 2057 E. 61st Place, Cleveland, Ohio, announces a new, No. 784 "Thrift Model," 4-in. pipe machine.

The heavy-duty, fabricated steel constructed floor type pipe machine has a standard range of 1 to 4 inches and an extra range of ½ and ¾ inch.

Being equipped with a front chuck which requires no wrench for operation, simplifies frequent changes of pipe sizes, because a spin of the handwheel moves the gripping jaws through the entire range in a few seconds. Rear



Protective Coating

Low-cost prevention of corrosion or abrasion damage to metal tools and parts during storage, handling or shipment, is foreseen in the strippable coating called Thermo-Cote D, just compounded by the Plastics Div., Ernst Bischoff Co., Inc. of Ivoryton, Conn.

The ethylcellulose base coating, which has been "tailored for commercial use," is applied by the hot dip process. Supplied in small blocks, it is melted in a thermostatically controlled melt tank and brought to the proper dipping temperature. Instruments, tools, dies, jigs and other parts are dipped, withdrawn and allowed to cool. Normally they can be handled in one or two minutes after dipping.

Special features of the coating are:

centering chuck is quick acting and nonbinding. This rear chuck, together with extra long spindle, provides maximum pipe support, prevents whipping and assures straight threads on long lengths.

A magnetic starter with push-pull selector switch for run and jog, controls the heavy-duty, 1800 rpm, 3-hp motor.

The unit's four spindle speeds are controlled by levers conveniently located to operator. Two quick-opening detachable lever operated die-heads cover the entire pipe and bolt range and are adjustable for over or undersize threads. Dies for the No. 784 are of the hobbed type made of high-grade tool steel and thread full length and taper, American National Standard pipe threads 1 to 4 inches. Dies for standard length and taper A.P.I. threads and bolt threads are also available. There are five segments to each set of dies. **T-2-1281**

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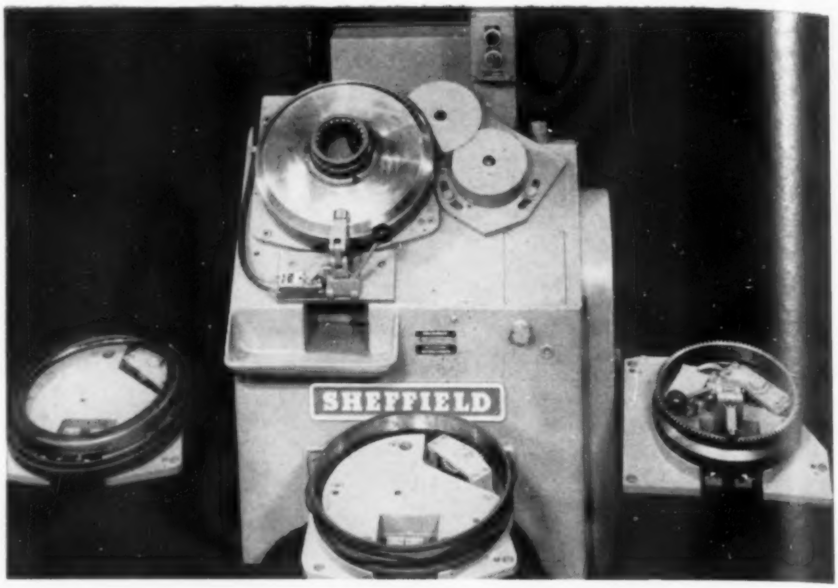
Rectangular Tool Bits

The duMont Corp., Greenfield, Mass., announces the addition of a complete standard range of super high speed rectangular ground tool bits to their present line of square bits.

The rectangular bits, made of the same carbon and vanadium material, are heat treated to achieve a very high Rockwell (66 to 68 "C" scale) and are ground to close tolerances without carburization. They combine balanced toughness, wear resistance and heat resistance. **T-2-1291**

relatively thin films applied at lower dip temperature, excellent stability and transparency. The melt is clear and transparent in the tank and remains homogeneous under heat. Parts requiring a double dip for complete coverage show no separation at the overlap. Recommended maximum dip temperature is 350 F. Prolonged heating to temperatures in excess of 360 F will tend to cause darkening and brittleness.

Thermo-Cote D has been tested for resistance to humidity by exposing coated mild steel panels for prolonged periods to an atmosphere of 100 percent humidity at 100 F without rust or corrosion on the steel panel. Its durability serves as a finished package for bulk shipment and storage. It is quickly removable by slitting and peeling, and is reusable. T-2-1292



Internal Burring

A type of internal burring machine, Model 388, is announced by The Sheffield Corp., Dayton 1, Ohio. It is designed for chamfering the involute contour of internal spline and gear teeth, either straight or helical around their full form.

Production rate depends upon the diameter and pitch of the gear teeth but is said to be up to and including 300 teeth per minute. It is a universal machine tool and can be changed over from one type of gear to another in less than 30 minutes.

Additional information may be obtained by writing to the company.

T-2-1301

Cylinders

The A. K. Allen Co., 57 Meserole Ave., Brooklyn 22, N. Y., has presented a line of double acting cylinders for air, water, or L.P. hydraulic operation, available in $1\frac{1}{8}$, 2, or 3-inch bore, any stroke, and with either single ended or double ended piston rods.

Unusual in such equipment is the fact that these cylinders incorporate Thomson Nylined bearings and "Copper-brited" honed cylinder tubes for

resistance to corrosion. Their main features of compactness and ease of assembly and disassembly are achieved by the fastening of the heads, squarely and rigidly, to the cylinder tube with rectangular section, hardened steel, snap rings reground flat and parallel and to 0.001 tolerance on thickness.

Adjustable cushions are available front or back on the 2 and 3-inch sizes and an assortment of interchangeable foot mounts, flange mounts and clevis mounts allows for mounting in any manner or position. **T-2-1302**

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Chuck Wrench

An inexpensive precision hand-tapping device, the Tappo chuck wrench, has been placed on the market by Gilbert Manufacturing Co., Elkhart, Ind. Among its advantages is the ease and simplicity with which it may be used; no special skill is required to obtain consistently accurate results. Savings result from minimized tap breakage since lateral tap strain is eliminated.

Work is ready to start as soon as workpiece has been set up, clamped and accurately aligned for tapping. The chuck wrench, placed on the drill press chuck, is manually rotated in the same manner as done in conventional style hand-tapping—with short strokes, backing up to clear chips.

Offering versatility, the wrench functions equally well when used for reaming, or when used as an attachment on a milling machine chuck. Tap or reamer depth is controlled by setting the drill press stop mechanism.

Tap capacity ranges from $\frac{1}{16}$-64 NS to and including $\frac{9}{16}$-12 NC; while reamer range extends from $\frac{1}{8}$ in. diameter to and including $\frac{1}{2}$ in. diameter. The Tappo chuck wrench fits conventional 6A, cap. 0-$\frac{1}{2}$ in. key style chucks which measure $1\frac{7}{16}$ in. OD at the keyhole body portion. **T-2-1311**

Punch Press

A bench model 1-ton press, developed by Alva F. Allen of Clinton, Mo., is particularly useful for short runs or small work because it frees heavier equipment and can be operated at lower cost.

Among the features of the Allen is a simple single-pin clutch, which gives positive clutching action and is operated by a convenient hand lever. On continuous operation, this Allen press has a capacity of up to 200 operations per minute. According to the manufacturer, considerable savings are possible with this Allen bench model due to the cost of dies. Punches and dies can be made cheaply, and in instances where only a short run is necessary, tools can be made of cold-rolled stock.

The ram of the Allen is designed for accurate adjustment and moved on machined ways to provide greater accuracy in operation. A gib provides for take-up of any wear. The Allen is operated by direct V-Belt drive.

T-2-1312

Magnet Wire

High temperature magnet wire in a wide range of sizes for class H service or better, and with fine electrical properties, has been announced by Hitemp Wires, Inc., 26 Windsor Road, Mineola, L. I., N. Y. Insulated with Teflon, the wire has a low loss factor, low dielectric constant (2.0-2.05 from 60 cps to 30,000 mc), and dielectric strength. Characteristics remain stable at temperatures from —100 C up to +260 C. Insulation is nonflammable, completely inert to moisture and all known commercial solvents and chemicals.

The solid conductor may be either soft or annealed copper, on which the Teflon enamel is dip-coated. Sizes range from 14-15 AWG, in six colors. Every lot is tested for abrasion scrape resistance, continuity, dielectric strength and thermoplastic flow before shipping. Single, heavy, triple or quad thicknesses are available; fine sizes are a Hitemp specialty. **T-2-1321**

Band Machines

A line of band machines has been introduced by The DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill., stressing production sawing and versatility.

Operations often performed on other types of machine tools, such as production slotting, slitting, serrating, shaping, notching, etc., can now be performed in many cases more rapidly

with the new band machines. Features which accentuate the production sawing application of the units, include greater rigidity, wider speed ranges, and versatile hydraulic controls.

Versatility, formerly confined only to larger model machines, has been incorporated in some of the smaller capacity models, and some of these are now able to receive band tools for filing, grinding, polishing, slicing, as well as for sawing. **T-2-1322**

THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

Literature Number	COMPANY	DESCRIPTION
A-2-228	Allegheny Ludlum Steel Corp.	**Cutting Tools**—8-page booklet tells how to effect production economies by using ALX for fast turning, boring and facing—in certain applications. Helpful information includes grinding, tool angles, speeds and feeds, brazing of chips. (Page 228)
A-2-218	American Broach & Machine Co.	**Broaches**—Circular 300 shows America's complete line of hydraulic surface broaching machines for high production. (Page 218)
A-2-177	B. C. Ames Co.	**Dial Indicators**—Free catalog 58 discusses a variety of dial indicator styles. (Page 177)
A-2-149	Anker-Holth Mfg. Co.	**Air & Hydraulic Cylinders**—Free bulletin gives complete line of Anker-Holth products. (Page 149)
A-2-204	Armour & Co.	**Coated Abrasives**—Free booklet "How to Store Coated Abrasives" describes Armour's complete line of paper, cloth, sheets, belts and disks. (Page 204)
A-2-233	The Bellows Co.	**Air Cylinders & Rods**—Free bulletin CL-50 discusses the range and possibility of air-cylinder devices. (Page 233)
A-2-284	Besly-Welles Corp.	**Taps**—Handy "Handbook for Tap Users" contains information on tapping methods and tap selection. (Page 284)
A-2-216	The Bristol Co.	**Socket Screws**—Free copy of Bristol's 40-page catalog describes Hex Socket Screws. (Page 216)
A-2-262	Brush Electronics Co.	**Surface Roughness Gage**—Booklet "Surface Finish Control" explains how proper surface control can reduce machine costs, increase plant capacity, and improve product performance. (Page 262)
A-2-247	Campbell Machine Div. American Chain & Cable Co.	**Abrasive Cutter Machines**—Booklet "Principles of Abrasive Cutting" tell advantages and specifications of an abrasive cutter machine. (Page 247)
A-2-225	Carboloy Dept. General Electric Co.	**Cemented Die Carbides**—Free booklet "Carboloy Die Engineering Manual, D-124" tells how to design, apply and maintain carbide dies. (Page 225)
A-2-221	The Cincinnati Milling Machine Co.	**Draw Die Tools**—A bulletin M-1759-2 describes economies involved by using Hydroform punch, draw ring, flange ring, redraw sleeve, and finish punch. (Page 221)
A-2-29	The Cincinnati Shaper Co.	**Press Brakes**—Catalog B-4 describes the versatility and production possibilities of Cincinnati Press Brakes. (Pages 28-29)
A-2-185	Clearing Machine Corporation	**Power Presses**—New O.B.I. catalog gives specifications and dimensions and explains construction of important press features such as frame, clutch, brake and controls. (Page 185)
A-2-250-2	Colonial Bushings, Inc.	**Drill Jig Bushings**—"Flip-a-page" catalog gives all necessary data on drill jig bushings. (Page 250)
A-2-231	The Cushman Chuck Co.	**Power Wrenches**—Bulletin 211D fully describes and illustrates the Cushman Power Wrench. (Page 231)
A-2-16	Danly Machine Specialties, Inc.	**Hydraulic Metalworking Equipment**—Bulletin explains how to combine such operations as riveting, punch extruding or trimming and multiple piercing, and thereby saving handling costs. (Page 16)
A-2-147	Dearborn Gage Company	**Precision Gage Blocks**—Ellstrom Standard catalog contains complete specifications and prices on the entire Ellstrom line of gage block sets, accessories, individual blocks, wear blocks, inspection service and trade-in plan. (Page 147)
A-2-132-2	Drillunit, Inc.	**Hydraulic Drill Units**—Catalog-Folder describes stroke capacities and specifications of drill units. (Page 132)
A-2-253	Eastman Kodak Co.	**Contour Projectors**—12-page booklet describes the Kodak Contour Projecter and how it can be applied to industrial inspection. (Page 253)
A-2-146	Engis Equipment Co.	**Diamond Compounds**—Technical Bulletin T-254 explains how to use Hyprez Diamond Compound for cutting tools and gages. (Page 146)
A-2-17	Gisholt Machine Co.	**Surface Finishing Machines**—New illustrated "Superfinish Catalog" gives typical applications for improving surface finish. (Page 17)
A-2-151	Guthery Machine Tool Corp.	**Automatic Screw Machines & Copying Automatics**—New 32-page catalog describes Guthery machines and illustrates sample parts which were made on Guthery machines. (Page 151)

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A-2-130	Hammond Machinery Builders, Inc.	**Grinding Fixtures**—Bulletin 235 discusses application of grinding fixtures to grinding solid carbide tools of various shapes such as round, square, triangular, and rectangular. (Page 130)
A-2-258	Hannifin Corp.	**Riveting & Punching Equipment**—Bulletin 150 gives the complete story of Hannifin "Hy-Power" hydraulic equipment. (Page 258)
A-2-169	The B. Jahn Mfg. Co.	**Dies**—Booklet gives picture story of various jobs and economies derived from Jahn dies. (Page 169)
A-2-201	Kearney & Trecker Corp.	**Special Machine Tools**—"Doorway to a proven method for solution of big and small metalworking problems" describes the facilities of a special machinery division. (Page 201)
A-2-8	Landis Machine Co.	**Threading Machines**—Bulletin H-75 discusses the versatility of and economies derived from Landis threaders. (Page 8)
A-2-163	Lehmann Boring Tool Co.	**Boring Tools**—Catalog BT-12 discusses reasons why Lehmann boring tools cut boring costs. (Page 163)
A-2-150	Lovejoy Tool Co., Inc.	**Inserted Milling Tools**—Catalog 28 describes the full line of Lovejoy tools inserted in holders. (Page 150)
A-2-25	Morse Twist Drill & Machine Co.	**Cutting Tools**—Morse has available a number of books concerning drilling, tapping, dies, reamers, end mills, counterbores, and milling cutters—regular or electrolized. (Pages 24-25)
A-2-242-1	Morton Machine Works	**Fixture Clamps and Components**—Free catalog describes the various designs of fixture clamps for cutting tool and design costs. (Page 242)
A-2-257	National Broach & Machine Co.	**Gear Shaving Machinery**—Bulletin S53-7 gives full details and nomenclature of National's gear shaving machinery. (Page 257)
A-2-223	Niagara Machine & Tool Works	**Pneumatic Clutches**—Bulletin 57-A gives full details of Niagara inclinable, open back presses, and discusses Electro-Pneumatic Clutches. (Pages 222-223)
A-2-34	The Ohio Crankshaft Co.	**Hardening Equipment**—Booklet "Typical Results of Tocco Induction Hardening" describes the speed and efficiency of Tocco induction heating equipment. (Page 34)
A-2-159-1	O'Neil-Irwin Mfg. Co.	**Die-less Duplicating**—A new catalog gives ideas for making parts by die-less duplicating. Bending manual gives exact methods for bending processes in a variety of materials. (Page 159)
A-2-135-1	Ortman Miller Machine Co.	**Cylinders**—Free catalog and set of ½- and ¼-scale templets shows all cylinders and mounting brackets for hydraulic cylinders. (Page 135)
A-2-236	Osborn Mfg. Co.	**Deburring Brushes**—New free booklet discusses case histories concerning the use of Osborn power brushes. (Page 236)
A-2-126	Omer E. Robbins Co.	**Magnetic Chucks**—Free copy of "Magna-Sine" catalog shows all styles, sizes, and prices of the Magna permanent magnet chuck. (Page 126)
A-2-187	Scully-Jones & Co.	**Torque Drivers**—Bulletin 20-50 gives important features, specifications, and field-tests reports on Safe-Test reports on Safe-Torque Drivers. (Pages 186-187)
A-2-278	Simonds Abrasive Co.	**Grinding Wheels**—Free folder ESA-62 discusses the various shapes and sizes of Simonds Resinoid bonded wheels. (Page 278)
A-2-159-2	The S-P. Mfg. Corp.	**Hydraulic & Air Cylinders**—Catalog 103 gives design features, instruction, and sizes of S-P hydraulic cylinders. (Page 159)
A-2-118-1	Standard Parts Co.	**Jig and Fixture Components**—A new 66-page catalog contains 150 drawings of components and discusses advanced engineering features. (Page 118)
A-2-196	The Torrington Co.	**Swaging Machinery**—Booklet contains complete descriptions of Torrington Rotary Swagers. (Page 196)
A-2-131-1	Waukesha Tool Co.	**Inserted Blade Tools**—New Waukesha catalog 25 explains applications, construction of the various Waukesha tools. (Page 131)
A-2-108	Zagar Tool, Inc.	**Drill Jigs**—Data Sheet "E-2" lists major components and defines features of standardized self-clamping drill jig. (Page 108)

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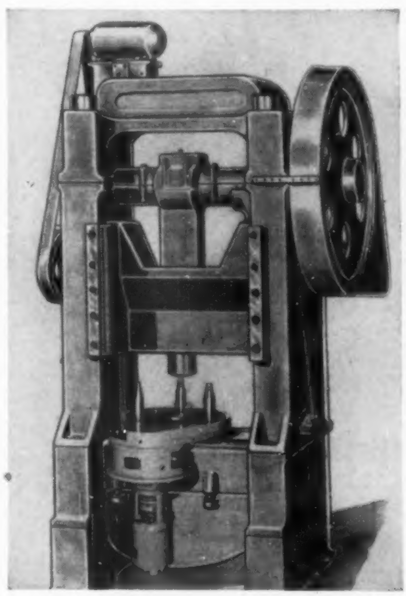
Automatic Press Loaders

Automatic loaders for stamping and forging presses, announced by Hautau Engineering Co., 721 Wanda, Ferndale 20, Mich., are designed to increase production as much as 300 percent over conventional manual-loaded press equipment.

A 120-deg index table with an offset flanged drive motor and index mechanism permits the mounting of the die punch at the optimum dead center ram position. Thus, maximum punch and die stability is provided and the loading of large die blocks is possible without punch interference.

Because only one punch is in the die area, maximum operator safety is provided as well as ample clearance between the die block and the outer punches.

The automatic loaders have a high-speed standard Hautau-Turndex, shock-



free, constant accuracy, modified cycloidal cam and shot pin index mechanism. They are particularly adaptable to the handling of second-operation stamping processes including piercing, forming and coining. Parts can also be processed through forging presses with the automatic loaders.

Production parts can be loaded and unloaded from the loaders either manually or by auxiliary feeding devices that provide completely automated press operations. Production rates of presses equipped with Hautau automatic loaders are limited only by the speed of the press.

The illustrated loader rotates in a clockwise direction on a crank press that coins the bodies of steel and copper rifle grenades. After coining, a grenade body is removed from the right-hand punch member, and an un-

finished part manually loaded in its place. At the left-hand punch position an auxiliary device forces the body over the punch. Each index is initiated by operating a push-button clutch control.

The press on which the loader is mounted is interlocked with the loader control assuring that the ram will not come down unless the index is locked in position. The index will not operate unless the ram is at the top of the stroke.

A finished part is produced with each stroke of the press. The index mechanism in this application is a 0.7-sec. type that permits a production rate of 1200 pieces per hour. **T-2-1351**

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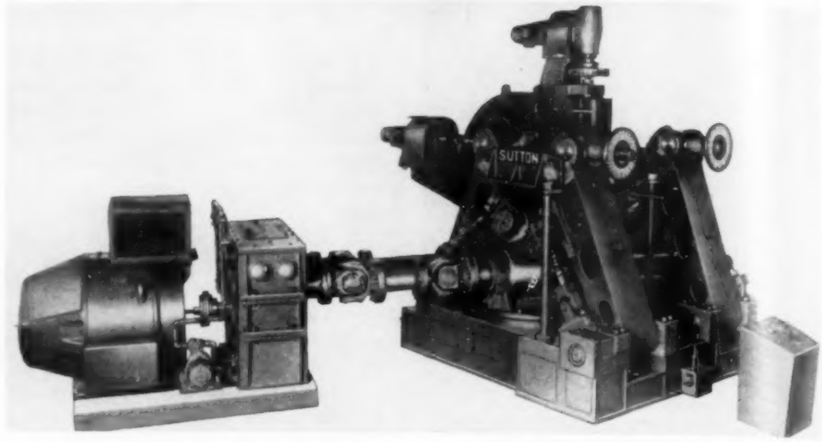


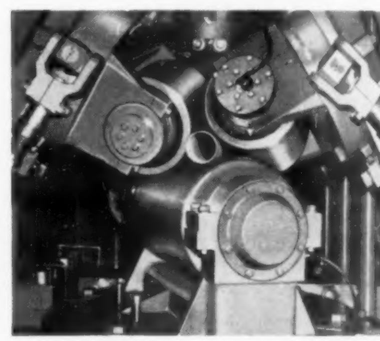
Seven-Roll Straightener

Accurate end-to-end straightening is assured by the advanced roll arrangement in a tube and bar straightener announced by the Sutton Engineering Co., Bellefonte, Pa. Designated 4 KTC, the straightener employs Sutton's exclusive seven-roll principle with cluster roll arrangement, which positively confines work to the pass line without guides.

One of the installations to date is the unit at a large steel mill, where a new 4 KTC straightener, equipped with a 150/200 hp 300/1200 rpm adjustable speed d-c motor, is being used for 4½ to 9⅝-inch OD hot finished seamless tubing. Straightening speed on this unit has a 60 to 240 feet per minute range.

Designed for 3⅝ to 12-inch OD tubes and bars from 3⅝ to 7½-diam, the 4 KTC straightener may be readily modified to meet specialized needs. Other straightening machines in the Sutton line of seven-roll design similar to the 4 KTC, are available in all sizes for a great variety of applications, and can be built to individual requirements.

Sutton's cluster roll arrangement employs a total of seven straightening rolls. A large driven roll with two opposed idler rolls are located at the entry end of the machine and another identical cluster is at the delivery end. In these clusters, rolls are positioned at approximately 120 degrees to each other. Between these three-roll clusters is an unopposed pressure roll. The arrangement



Photograph shows close up of important details involved in the straightening principle incorporated in machine at top of page.

eliminates the use of all guides.

Power-operated screw downs and automatic coordinated angling of rolls cut the time to less than three minutes for complete changeover from minimum to maximum size. Roll angles are automatically adjusted to the proper setting for the size of material being straightened with full contact between work and rolls.

From a centralized panel, the operator controls his main motor and his straightening speed, making his size adjustments by means of three motorized adjusting screws. A single operator controls the over-all operation from a single pulpit. **T-2-1361**

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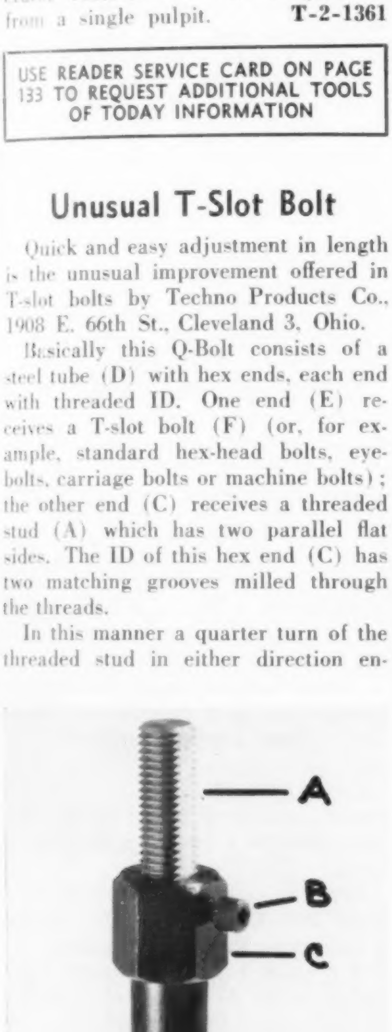
Unusual T-Slot Bolt

Quick and easy adjustment in length is the unusual improvement offered in T-slot bolts by Techno Products Co., 1908 E. 66th St., Cleveland 3, Ohio.

Basically this Q-Bolt consists of a steel tube (D) with hex ends, each end with threaded ID. One end (E) receives a T-slot bolt (F) (or, for example, standard hex-head bolts, eyebolts, carriage bolts or machine bolts); the other end (C) receives a threaded stud (A) which has two parallel flat sides. The ID of this hex end (C) has two matching grooves milled through the threads.

In this manner a quarter turn of the threaded stud in either direction en-



gages or disengages the thread from the body of the bolt, permitting the stud, when disengaged, to move freely up and down in the tube. This allows the over-all length of the Q-Bolt to be quickly adjusted to the precise position required for most advantageous use. Once engaged, the stud is held securely in position by the thumbscrew (B), which need only be finger-tight, and can again be loosened with the fingers regardless of the strain to which the stud has been subjected.

Made throughout of high-strength alloy steel, the Q-Bolt has successfully withstood the severest tests for tensile strength and wear resistance.

Among its advantages, this bolt can be securely locked onto the T-slot table by tightening the body down on the T-slot bolt. For repetitive setups, the Q-Bolt thus remains accurately in place, ready for the next workpiece, without any additional adjustment.

Further, the threaded stud can always be positioned so that it does not extend past the nut.

A small number of different length Q-Bolts replaces scores of sizes of standard and special length T-slot bolts.

The Q-Bolt can be made an integral part of jigs and fixtures. Any wear on the bolt will then be confined to the stud, which can easily be replaced without disturbing the fixture. T-1371

USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Hex Feed Finger

Balas Collet Mfg. Co. announces an improvement on all their two-split feed fingers designed for use with hexagon stock.

The feed fingers have a hex chamfer in the back hole to enable to operator to be certain that the stock is in line with the hex in the feed finger when loading stock. According to the maker, this will increase feed finger life and prevent breakage by preventing across-corners conditions when loading stock in automatic screw machines.

Full information may be obtained by writing to the manufacturer, Cleveland 14, Ohio. T-1381

ardness Tester

Pa... Transducer Corp., 11921 West Pico ...d., Los Angeles 64, Calif., announ... a precision type portable sheet metal ...rdness tester, Model 317, which offers a precise method of testing the hard... of all types of both ferrous and ...nferrous sheet metal.

By use of a calibrated microscope and ...ticle, readings can be obtained well within 2 points in the Brinell scale.

The microscope has a self-contained battery type illuminator.

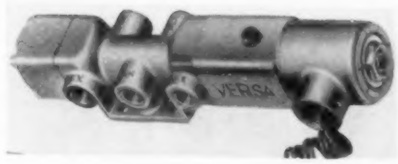
Sheet stock of from 0.010 to 0.250 inch may be measured. The instrument operates by using a 1/8-inch ball with 150 KG load. A precision ground spring which is used to load the ball remains in constant calibration. Pressure on the sheet is applied by a special pair of parallel jaw pliers. The indentation so formed is measured with the microscope. Readings in the Brinell scale are direct. It is not possible to squeeze the pliers too hard as there is a limiting pad which forms all indentations with the same load. **T-2-1391**

USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Solenoid Valves

Electrical operation of the entire line of 2-, 3-, and 4-way valves in 1/8 through 1/2 NPT sizes, manufactured by the Versa Products Co., Inc., 249 Scholes St., Brooklyn, N. Y., is possible through its recently developed solenoid actuating device.

Of the secondary pilot operating type, a relatively small solenoid controls a pilot cylinder in the valve, to provide



fast, positive force for shifting the valve spool. This solenoid cylinder method of actuation is conceded dependable, safer, smaller, faster, lighter, and less expensive to operate than direct solenoid actuation.

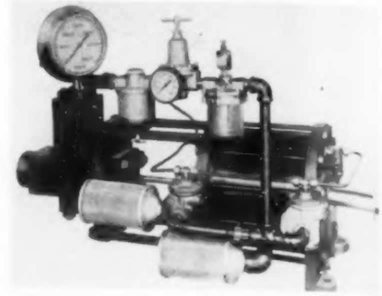
These valves accommodate a variety of actuating devices; they may be repositioned by spring return or by any of the other Versa actuating devices, or a second solenoid may be employed for this purpose.

No additional line is required for the solenoid pilot cylinder when Versa solenoid valves are used for pressures up to 150 psig, since these valves are internally drilled to supply main line air or fluids to the solenoid pilot. For controlling hydraulic pressures over 150 psig up to 500 psig, an auxiliary low pressure line of 35 to 150 psig is needed to supply the solenoid pilot.

Among the valves main features is the "anti-extrusion" arrangement of all the kinetic 0 ring seals in each valve type which accounts for the airtightness after more than three million cycles of operation. This makes it impossible to cut the seal rings in the normal operating pressure range. **T-2-1392**

Air Driven Pun

The Aldrich Pump Co., entown, Pa., announces production an air driven hydraulic pump. Av able in single- or double-acting mo els, the unit is a simplex horizontal pe, designed to demand for small ume capacity at medium and high essures. This pump develops up to 2 000 psi operating on 90 psi air supply; s a self-contained machine complete with air filter, regulator, lubricator and hydraulic pressure gage, and can be operated wherever air pressure is available. This Aldrich pump provides economy of operation for such applications as testing tubing, valves and pressure vessels, as well as supplies power for small molding presses. T-2-1401

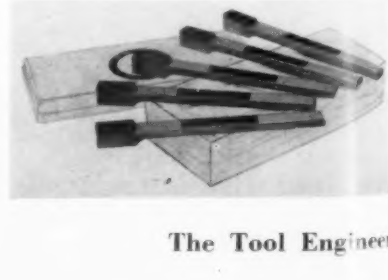


USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Dressing Tool

Cost cutting of diamond wheel operation with an assured longer carbide tool life between grinds results from use of a diamond dressing tool introduced by United States Diamond Wheel Co., 835 Illinois Ave., Aurora, Ill.

The device is a hand hone tipped with diamond concentrate. A patented feature, involving finger-tip control by means of a hollowed-out finger rest near the end of the hone insures more accurate operation. This control permits the hone to fit firmly in the hand for accurately controlled tool dressing without removing tool from machine. It is available in single or double end styles and in all required Diamond Grit size. T-2-1402



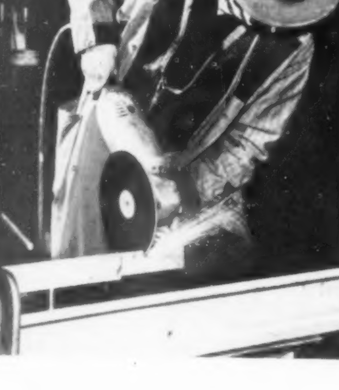
Grinding Wheels

The Carborundum Co., Niagara Falls, N. Y., announces Carboflex depressed center grinding wheels for rough grinding, weld removal, cut-off and cutting operations for ferrous and nonferrous metals and nonmetallics. The glass-fiber-reinforced resin bond wheels provide efficient operation with maximum safety, and combine cutting action with extreme high strength and resistance to cracking.

Designed with a knurled back in addition to the knurled face, the new wheels enable the operator to cut with both sides and the periphery of the wheel without any initial dressing.

The wheels come in sizes of 7 and 9½ in. in diameter; ⅛, $\frac{3}{16}$ and ¼ in. in thickness and contain a ⅞-in. arbor. Grading A24-R-BC is recommended for metal applications, and grading C24-R-BC is used for nonmetallics.

T-2-1411

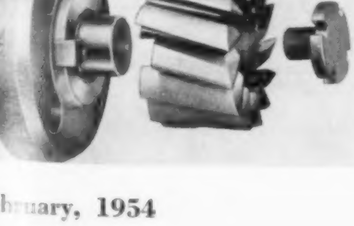


Adapter for End Mills

Goddard & Goddard Co., 12280 Burt Rd., Detroit, Mich., has developed a different quick-change type shell end mill adapter. Standardized for No. 50 N. S. drive milling machines, it is made available in two arbor sizes which fit standard shell end mill bores.

The adapter mounts directly on the front spindle flange of the machine. Standard bolt holes and key slots provide for rigid mounting and positive drive.

Greater tool rigidity is provided by



bolting direct to the spindle, giving a full bearing on the spindle face, thus helping to produce better work finishes by minimizing tendency to chatter. Concentricity is assured by locating from the OD of the spindle.

Manufactured from 8620 steel and case hardened, the adapter has hard bearing surfaces that will not score.

All locating surfaces are ground parallel and concentric for true mounting and acurate cutting. T-2-1412

USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Vise for Compressible Materials

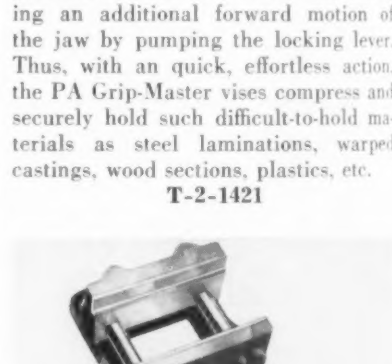
Instant-Action Grip-Master vises that permit clamping of compressible materials normally requiring slow-action screw-type vises, are being introduced by Heinrich Tools, Inc., Racine, Wis.

Known as the PA series, featuring patented "Pumping Action" locking mechanism, they include four models with 3, 4, 6 and 8-inch wide jaws. These are available as additions to the standard SV series.

All Grip-Master vises advance the jaw forward against the object to be held with the initial downward press of the locking lever, exerting holding pressures up to 1,500 lb.

In the PA series, releasing the locking lever to a 60 to 80 deg angle, the jaw is held against the work with a pressure of from 200 to 350 lb, allowing an additional forward motion of the jaw by pumping the locking lever. Thus, with an quick, effortless action, the PA Grip-Master vises compress and securely hold such difficult-to-hold materials as steel laminations, warped castings, wood sections, plastics, etc.

T-2-1421



Readers' Viewpoint

To the Editor:

With regard to "Analytical Methods for Deriving Cam Profiles" by Zbigniew Jania in the October issue of THE TOOL ENGINEER, there is, in my opinion, a misprint on page 85 under the heading "Off-Set Follower." I believe the third expression should read:

$$r = \sqrt{R^2 + 2R\,f(\theta) + [f(\theta)]^2 \cos\alpha}$$

Jania shows how to determine the actual dimensions of the cam profile by X and Y. He does not show how to find the actual dimensions of the profile in polar form. Equations for this would be:

$$r_o = \sqrt{r^2 + d^2 - \frac{2dr^2}{\sqrt{(r')^2 + r^2}}}$$

$$\sin\beta = \frac{d}{r_o\sqrt{1 + \left(\frac{r}{r'}\right)^2}}$$

Yours very truly,
Adelbert Eichler
New Toronto
Ontario, Canada

To the Editor:

Mr. Eichler is correct in pointing out the unfortunate typographical error. Of course the "cos α" term belongs in the expression. He might also have mentioned the other errors: the three "α's" on page 82 that should have been "β's" and the plus sign that should have been a semi-colon in Equation 4, page 88.

As regards the equations in polar form, it can be seen that lengthy computations would be required to obtain these quantities for each point of the cam contour.

Furthermore, the second equation gives angle β, which is not the basic independent variable, angle of rotation θ. Angle β is a function of θ and as such does not give a time-angle of rotation for which a given r_o is calculated. Moreover, I feel that in actual practice, equations for true contour of the cam would never be used, as the chief point of interest lies in pitch line dimensions, which are used to cut the cam profile.

Yours very truly,
Zbigniew Jania
Detroit, Mich.

Gentlemen:

I want to thank you for the prominent and attractive digest of my paper on "Automatic Machine Control" in THE TOOL ENGINEER, Dec., 1953, page 144. Unfortunately, Fig. 4 is in error in that the photograph shown as a finished part represents only the first stage of fabrication of the aircraft fitting. Considerably less than six hours' machine time was required to reduce the billet to the form shown in the figure. The accompanying photograph correctly illustrates the finished fitting after a series of fabrication stages, including three hours' hand finishing.

I am indeed sorry that this misunderstanding has occurred, and should there be any further information of interest, I will be glad to assist in any way possible.

Very truly yours,
Ultrasonic Corp.
Perry L. Nies
Contract Dept.

Technical Shorts...

Drying Technique for Protective Coatings

Development of a new technique for drying rapid of protective and decorative coatings of inks, paints and varnishes has been announced by Armour Research Foundation working on a project sponsored by the Meyercord Co. As a result, drying time on coated products has been reduced from a 24-hour period to a bare 2 to 20 second wait.

Foundation researchers say the process, called Chem-Dry, has combined improved quality with reduced costs. Undoubtedly it will find wide usage in many fields such as metal decorating, wire coating and wood finishing. Based on a chemical reaction between applied coatings and sulfur dichloride vapor instead of the commonly accepted polymerization or oxidation, the substance dries without use of heat. The material coated by printing, roller coating, brushing, spraying or dipping operations, are conveyed into a chamber through which a mixture of sulphur dichloride vapor and air is circulated. The machine doing the work is constructed so that vapors adhering to the material are removed. All air exhausted from the system is scrubbed with dilute caustic soda solution to remove any remaining vapor.

Although the Chem-Dry process is now being made available to industry, it is pointed out that each industry will require engineering and production techniques especially designed for its own operations.

* * *

Steel "Cooking"

Stirring the melt in an electric arc furnace has understandably proved somewhat a problem up to now. The melt must be stirred to speed up the process and also provide more uniformity of the bath, but just how to stir tons of liquid steel has been the sticker. Rabbling, or hand method, which has been done in the past, has obvious drawback, as does the method which calls for an ingot of steel to be towed around in the melt by means of a crane.

Now Westinghouse Electric Corp. has instituted a way which appears to be a sound solution. It uses a d-c excited electromagnet, operated by remote control. The magnet is rotated below the arc furnace. The strong flux field enters the furnace from one pole, passes through the melt, and out to the other pole of the magnet. This action creates currents in the steel, establishing a circular flow within it.

About 165 kw is required for the rotating magnet, which is driven by a 50-hp motor.

* * *

Powerful Magnets from Ceramics

Ceramic material, which is lighter in weight than metal and requires no critical ingredients, is used in the unusual type of magnet just announced by The Indiana Steel Products Co. of Valparaiso, Ind.

This permanent magnet, called Indox, may be expected to open new fields for use of magnets in industry and in consumer items.

In addition to bêing lighter than the

present commonly used metallic permanent magnets. Indox has twice as much coercive force, and is a nonconductor. And, it is virtually impossible to demagnetize by ordinary means, according to Robert F. Smith, president of the firm.

Although it is composed of materials which are "earthy" in nature and nonorganic and nonmetallic, it is magnetized in the same manner as metals.

It is made from noncritical materials, iron oxide and barium carbonate, and goes through a number of critical cycles in powder preparation, pressing in dies and heat treatment. It was developed in the research laboratories of N. V. Gloeilampenfrabrieken at Eindhoven, Holland. It is considered the first new magnetic substance since the development of Alnico in 1931.

Apparently uses for these magnets are those in which application limits magnetic lengths and in which the magnet may be subjected to high demagnetizing forces. In applications involving high frequency, the high resistance minimizes eddy currents.

Indox is characterized by short magnetic lengths, with an optimum working point of approximately 1,000 gauss at 800 oersteds. However, it can withstand demagnetizing fields above 2,000 oersteds without large loss of magnetic flux.

For its production The Indiana Steel Products Co. has constructed a new and specially equipped addition to its plant in Valparaiso, where commercial output of the new magnet is expected to begin by the end of 1953.

* * *

X-Ray Source Promises Broader Use

WORK NOW IN PROGRESS at Armour Research Foundation of Illinois Institute of Technology may soon lead to a commercially available small self-contained source of x-rays for use in industry. Research will center around development of a pocket-size radiation source invented by Dr. Leonard Reiffel, supervisor of the Foundation's nuclear physics section. Several big advantages will be brought about with this development. The new x-ray source can be made in almost any size, from tiny pellets to larger blocks or sheets; it is entirely self-contained, requiring no bulky electronic equipment and no wiring connections as in conventional x-ray generators now used in industry and medicine. Radiation emitted is essentially the same as that emitted by x-ray tubes, but is of lower intensity.

Of particular interest to industry are the foreseeable possibilities of x-ray for use in inspecting vital parts. Though it

is now used, equipment needed is too bulky to make its usefulness at all broad. With the new source this use would be simpler, easier and have fewer limitations. The scientists explain applications in this direction by using an x-ray picture of an airplane wing. The radiation source could be put inside the wing and film placed around the outside. When the film was developed, engineers would have an x-ray picture of the wing structure.

Researchers believe this would be superior to somewhat similar methods now in use employing radioaction isotopes, since present pictures produced in this way are often inferior to ones made with x-rays, which give higher contrast hence offer clearer examination possibilities.

The new x-ray source operates on the "Bremsstrahlung" principle, which simply involves a small quantity of radioactive material that is surrounded by a layer of some heavy metal.

The radioactive center emits a form of energy known as Beta rays, consisting of high energy electrons. These drive out through the atoms in the surrounding metal. Their change in direction brought about by deflection from straight-line paths through the metal produces the form of energy called x-rays.

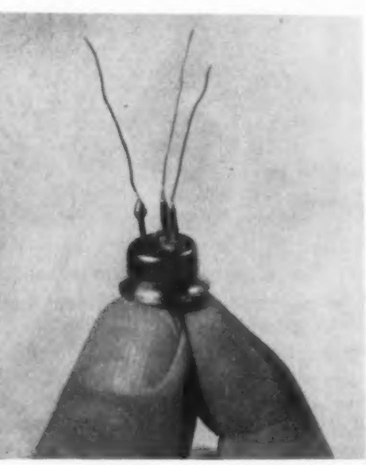
Both quantity and quality of x-ray energy coming out of this Beta ray to x-ray converter can be regulated by varying the core material and the thickness and composition of the shell.

To "turn off" radiation, the heavy metal shell around the radioactive center is simply replaced by a plastic sheath that absorbs Beta rays without forming x-rays. This point is yet a further advantage over ordinary radioisotopes.

* * *

More Power From Midget Transistor

NO BIGGER THAN a thimble, the transistor developed in the research laboratories of Minneapolis-Honeywell Regulator Co. boasts an output of 20 watts, and an ability to do work not considered possible with present low-output types. Thus a considerable expansion in the range of transistor uses is anticipated. As an example of the future expected, Dr. Finn J. Larsen, research director, pointed to the major



role the little power unit would be likely to play in improving automatic controls of the future.

The transistor's output of 20 watts contrasts with the 20 hundredths of a watt for present commercial types of electronic midgets currently replacing vacuum tubes in many applications. According to Dr. Larsen, this greater power enables it to do things heretofore such unexpected work as operating motors, valves, relays and other equipment.

Although the transistor is not yet in commercial production, a prototype aircraft electronic fuel gage making use of it already has been built by the company.

Abstracts of Foreign Literature

By M. Kronenberg

Geometry of Manufacturing Irregular Surfaces

A thorough study by W. H. Gres on the geometry of generating irregularly shaped surfaces has recently been published by Springer Verlag Berlin-Heidelberg. In this book the author explores the principles that govern metal cutting for copying of workpieces. He establishes formulas and rules that should be followed in the design and application of tracer controlled machine tools for highest accuracy and efficient production.

The author starts with a study of the various combinations that are mathematically available for indicating the conditions for generating surfaces in three dimensions. He presents a table of the geometrical order of surfaces that can be produced by metal cutting. He differentiates between curves or surfaces determined by a shifting motion within a Cartesian coordinate system and curves or surfaces determined by a rotary motion with a system of polar coordinates. In addition he introduces the concept of the stationary templet and the nonstationary templet. In this way he is able to cover all variations that may practically occur in regular and irregular surfaces.

He investigates also the relative difficulties in manufacturing such surfaces, concluding with five classes, namely: regular surfaces such as cylinders, irregular surfaces of the first order of manufacturing difficulties such as sloping surfaces, irregular surfaces of the second order of manufacturing difficulties including surfaces such as turbine wheel buckets and two higher classes of manufacturing difficulties.

There are basically three metal cutting methods available for generating these surfaces, namely: (1) the traditional method where the surface is produced without the aid of a templet or similar controlling mechanism, (2) copying methods employing templets, cams, perforated tape records, etc., and finally (3) the method of generation of surfaces by means of linkage systems, elliptic and other gears.

The second class of metal cutting

methods takes the greatest portion of the book analyzing principles of turning, milling, planing and broaching. Manufacturing of hyperbolic surfaces by inclining a broad nose tool reduction and amplification methods pantograph methods, profile grinding, surfaces encountered in aircraft design and sine curves are also included in topics discussed.

The book requires a good understanding of German because of frequent coining of new terms but presents the information well. An English translation would be desirable.

Forging Cast Iron in Closed Dies

A new process making it possible to press work or forge cast iron parts for the first time is described by W. Schlegel in the November 1953 issue of *Werkstattstechnik und Maschinenbau*. According to the author it is possible in this way to increase the tensile strength of cast iron up to threefold and to obtain dimensional accuracy permitting in many cases elimination or substantial reduction of machining operations.

While flash occurring in common forging operations of steel is in a radial direction with respect to the stroke, it is axially directed in the new forging method. In this way, locking action caused by the flash is prevented along with the resultant high internal stresses. These stresses have been the cause of cracking in cast iron when tests have been made to forge it previously.

Pressing in a closed die requires careful observation of the volumetric law to the effect that a body subjected to plastic deformation changes its shape but not its volume. An entirely closed die would either explode or stall the press if the volume of the precast blank were too large. To eliminate this hazard and the necessity of carefully holding close tolerances in the blank, the escape of surplus material must be permitted in such a way that high stresses are eliminated.

Photomicrographs illustrating the article show that the flow lines of the material are arranged the same as those of conventional forged steel, which is taken as an indication of the great increase in tensile strength.

The forging temperature is relatively low, namely only about 1500 F, which permits holding close tolerances in workpiece similar to powder metallurgy. The Croning process can be united with this method in the manufacture of various cast iron articles. The author quotes a number of exam-

ples ...trating the increase in tensile stren... among them one of forging com... cast iron where the strength was ...reased from 19000 to 56500 psi and ...ther instance of spheoridized cast ...n where the strength increased from ...,000 to 14,500 spi.

Th... process requires only one forging ... to transform a precast blank of simp... shape into the finished forging, holding close tolerances and securing high strength. The new process is being used in Germany, in various industries to obtain substantial savings for manufacturing hubs, links, gears, radiator parts and many other parts.

Surface Finish

Another meeting on surface finish, held in June 1953 by the German Standard Association, may have far reaching effects on the standardization of measuring and interpreting of surface finish. This meeting continued the work of a previous one held in November 1952. A report on the June meeting appears in the November 1953 issue of *Werkstattstechnik und Maschinenbau* indicating that the German Standard Association after extensive deliberations has decided to adopt the American method of using the height root-mean square (H_{rms}) for designating surface finishes.

Among the reasons given for the adoption of the H_{rms} system is the fact that export of machinery from Germany would be facilitated because of substantially smaller values recorded by determining the H_{rms} instead of indicating roughness measured from top to bottom of waves.

Other reasons lie in the availability of instruments for measuring surface finish. In the USA electrical integrating devices recording the above mentioned unit are used. In Germany the Forster-Schmaltz optical instrument using interference of light for measuring surface finish gave an entirely different value of the same surface. France, where the Solex instrument is used, and England employing the Talysurf device, are considerably affected by the interpretation of surface finish.

The German standard No. 4762 hitherto used for surface finish will, however, not be eliminated but rather supplemented by the H_{rms} system.

Before it will actually be possible to use this new system in Germany other difficulties will have to be overcome, among them the difference between the English and the metric measuring bases. The microinch of the English system gives an odd value in metric system and must therefore be replaced by a comparable but easily measurable dimension.

good reading

INDUSTRIAL SPECIFICATIONS *by E. H. Mac Niece. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. Price $4.50. 158 pp.*

The author demonstrates proven methods of planning, writing, and issuing specifications for the various phases of industrial operation, providing the basic information necessary for the advanced application of these methods. He also relates accuracy of measurement with the ability to better specify and stresses the relation of technical and economic factors in manufacturing, buying, and selling.

Included are a number of actual specifications issued by leading business concerns and governmental agencies.

MECHANICAL VIBRATIONS *by W. T. Thomson. Published by Prentice-Hall, Inc., 70 Fifth Ave., New York, N. Y. Price $6.00. 252 pp.*

The aim of this book is to present the fundamentals of vibration theory and provide a general background for advanced study. Rational analysis developed from basic principles is emphasized. No familiarity with differential equations is presupposed.

Introductory material is treated by detailed discussion of basic systems and equations common to a variety of problems.

YEAR BOOK OF THE AMERICAN BUREAU OF METAL STATISTICS, *published by the American Bureau of Metal Statistics, 50 Broadway, New York, N. Y. Price $3.00. 120 pp.*

This book presents a complete statistical picture with respect to the economics of the non-ferrous metals on a world wide basis. Production, consumption, and operating details for copper, lead, zinc, gold and silver are treated in detail. Other information compiled by this organization is available through subscription to periodic reports and the Year Book.

REVIEW OF CURRENT RESEARCH AND DIRECTORY OF MEMBER INSTITUTIONS, *Published by the Engineering College Research Council of the American Society for Engineering Education, V. E. Neilly, Sec., 103 Mechanical Engineering, Pennsylvania State College, State College, Pa. Price $2.50. 330 pp.*

Designed to give a picture of research programs at all member colleges, this paper-bound book serves as a handy aid. Published biennially, it reviews 7,500 projects at 103 institutions.

The book gives the names of responsible administrative officers, policies governing projects and contracts, personnel engaged in research activities, annual research expenditures, sources of income, and special conferences and short courses of interest to research people.

ABSTRACTS OF THESES, *Published by Massachusetts Institute of Technology, Cambridge, Mass. Price $2.50. 222 pp.*

The first part of this publication contains abstracts of theses accepted by the Massachusetts Institute of Technology in partial fulfillment of the requirements for the degrees of Doctor of Philosophy and of Doctor of Science awarded from 1952-'53. The second part lists by title theses accepted for the various professional engineering degrees.

WELD STANDARDS, *Published by The Lincoln Electric Co., Cleveland 17, Ohio. Price $1.00 in U.S.A., $1.50 elsewhere. 19 sheets.*

To enable the engineers of machinery manufacturers and fabricators to acquire both cost and quality control over welding operations, the Lincoln Electric Co. has created a set of weld standards. The set of 19 sheets on tracing paper is loose-leaf bound.

TOOL DESIGN AND TOOL ENGINEERING HAND BOOK, *Published by John G. Jergens, 18107 Invermere Ave., Cleveland, Ohio. Price $3.88 plus 12 cents postage. 492 pp.*

This book gives handy access to all tables, formulas, constants, and specifications needed by tool engineers, designers, shop foremen, and students.

Included are the latest developments and complete data as well as many suggested design details and concise, practical information. The book contains over 600 inked drawings and illusrations and is completely indexed.

Men at Work . . .

W. H. C. Berg has been named director of standards and research for the Hanson-Whitney Div. of Whitney Chain Co. Mr. Berg is considered an authority in the field of metallurgy, having been engaged for more than 30 years in this work.

Bart C. Dickey has been made process development engineer in the production department of Acheson Colloids Co. In this position, Mr. Dickey will be responsible for improving and developing process operations for current and new products.

A. L. Foscue has been appointed president of Electro Metallurgical Co. and United States Vanadium Co., divisions of Union Carbide and Carbon Corp. Mr. Foscue succeeds **Walter E. Remmers** who now becomes chairman of both divisions and a member of the Appropriations Committee of Union Carbide. He also is a vice-president of the parent company.

Announcement of the appointments of **Robert E. Byrne** as chief engineer and of **Charles T. Mooney** as production superintendent has been made by Worcester Pressed Steel Co.

The board of directors of The Geometric Stamping Co. has elected **Dave R. Jones,** chairman of the board, to the office of president. Mr. Jones had previously served as president from 1915 to 1950. At the same time, **E. F. Carney,** who has been vice-president in charge of sales, was elected vice-president and general manager.

Recent election of **Robert E. Tanner** to the office of vice-president and general manager has been announced by Carver Pump Co. Mr. Tanner also assumes the post of general sales manager having previously been engaged in sales work for Continental Can Co. and National Can Co.

Recent appointment of **W. C. O'Connell** to the post of general manager of General Electric Co.'s Aircraft Accessory Turbine Dept., has been announced. Mr. O'Connell replaces J. S. Parker who has been acting general manager of the department and now continues his duties as general manager of the Small Aircraft Engine Dept. in Lynn.

Pennsylvania Peerless Corp. has announced the appointment of **John Schlarb** and **Vern Wilson** to the posts of works manager and general foreman respectively. Both men come from Peerless Production Co. in Detroit where they held these same positions.

Kenneth L. Walker has been appointed superintendent of the Mountain Top, Pa., plant of Foster Wheeler Corp. Before being assigned to this new plant, Mr. Walker was superintendent of the boiler shop at the Carteret plant of the corporation.

Harold W. Sweatt, president of Minneapolis-Honeywell Regulator Co. since 1934, is now vice-chairman of the board, succeeding Mark C. Honeywell who became its honorary chairman.

William J. During has been elected president of Precision Castings Co. following the retirement of Arthur G. Chase. He formerly was executive vice-president of the firm.

J. Lawrence Buell, Jr., formerly associated with Reliance Electric and Engineering Ci., is the new president, general manager and a director of The Formsprag Co.

E. W. Bliss Co. has made the announcement of the appointment of **M. E. Dorman** as manager of materials for the Canton division. In addition to supervising the Canton division's purchasing department, Mr. Dorman will be in charge of inventories, stores and receiving operations.

New managing engineer for the Anodes Div. of Sipi Metals Corp. is **William O. Bosserman.** For the past 25 years, Mr. Bosserman has been associated with the nonferrous field thus accumulating experience in all phases of plating problems as related to anode use.

Recent appointment of **David Reid, Jr.** as manager of the Abrasive and Bond Plants has been made by Norton Co. Mr. Reid, formerly superintendent of the plants, succeeds **Albert E. Hall** who retired. Following in the position of superintendent, is **Robert G. Clarke** who was assistant superintendent.

James E. Fifield is vice-president and general manager of newly-reorganized Ductile Iron Foundry, Inc. He had been with International Nickel Co.

TRADE LITERATURE

For Free Booklets and Catalogs — Convenient Request Card on Page 133

Hydraulic Presses

Picture catalog shows representative hydraulic presses and equipment from company's line of machines for metalworking, rubber, plastics and woodworking industries; includes specifications. R. D. Wood Co., Public Ledger Bldg., Independence Sq., Philadelphia 5, Pa. L-2-1

Positioners

Well illustrated with drawings and photographs, Catalog B covers line of positioners for broad variety of work; includes discussions of applications, outlines of specifications, special features, and construction advantages. Aronson Machine Co., Arcade, N. Y. L-2-2

Dial Indicators

Illustrated catalog describes line of precision instruments for checking including dial indicator test sets, depth gages and lens measures; outlines advantages, gives specifications and prices. Chicago Dial Indicator Co., 180 N. Wacker Dr., Chicago 6, Ill. L-2-3

Teflon Finishes

Third revision of technical bulletin on Du Pont's Teflon resin finishes lists variety of successful applications, discusses use of material, its properties and advantages. Du Pont Finishes Div., Room D-7145, E. I. Du Pont de Nemours & Co., Wilmington 98, Del. L-2-4

Gaging Instruments

Condensed bulletin presents broad line of specialized instruments and gages including those for accurate measurement of combustion, pressure, flow, vacuum, velocity, static pressure, and many other uses; gives characteristics of each and its general applications; includes pictures and specifications. F. W. Dwyer Mfg. Co., 317 S. Western Ave., Chicago 12, Ill. L-2-5

Screws

Booklet TL-88, "Tapping Screws," describes in detail seven different types of screws which form their own threads, emphasizing main features; selection charts give screw recommendations for various materials including steels, ferrous and non-ferrous castings and forgings, plastics, wood and compositions. Townsend Co., New Brighton, Pa. L-2-6

Straightening Equipment

Eight-page illustrated Bulletin No. 25 describes representative examples of line of straightening equipment for various requirements; shows principles of different designs, presents detailed information on various important features. Sutton Engineering Co., Bellefonte, Pa. L-2-7

Presses

Hydraulic bending, straightening and plate forming presses presented in comprehensive 16-page Bulletin 10.1; each unit pictured with outline of its special use, important features and best application. Lake Erie Engineering Corp., P.O. Box 68, Kenmore Sta., Buffalo 17, N. Y. L-2-8

Electronic Balancing

Bulletin 49 offers comprehensive description of company's Electrodyne for automatically measuring by electronics the amount and indicating the angular location of unbalance. Also covers features of complete line of Electrodyne dynamic and static balancing machines. Tinius Olsen Testing Machine Co., 2010 Easton Rd., Willow Grove, Pa. **L-2-9**

Universal Joints

Illustrated 12-page brochure on Rzeppa universal joints covers applications, engineering data, models and sizes, proper joint selection and other details, as well as a detailed discussion of constant velocity, the principle on which these joints are designed. Write directly to the Joint Div., Gear Grinding Machine Co., 3901 Christopher, Detroit 11, Mich.

Stampings

Information on die and stamping costs for small quantity stampings presented in pamphlet; shows particularly cost of tools and production of 1000 pieces. Includes specifications for maximum blank size, blank thickness and blanking pressure. Dept. KP-B101, Federal Tool & Manufacturing Co., 3600 Alabama Ave., Minneapolis 16, Minn. **L-2-10**

Controlled Volume Pumps

Data presented in Bulletin No. 1053 on air-powered controlled volume pumps includes details on pump operating principles, examples of complete engineered chemical feed systems, descriptions and drawings of construction and operating features; also contains capacity-pressure and air-consumption tables. Milton Roy Co., 1300 E. Mermaid Lane, Philadelphia 18, Pa. **L-2-11**

Air Valve

Engineering bulletin No. 61861 gives details concerning the "Wobble-rod" air valve. Describes operation, gives variety of application ideas, and includes specifications and price data; sectional drawings allow study of its special features. Pantex Manufacturing Corp., P.O. Box 660, Pawtucket, R. I. **L-2-12**

Wet Blasting

Model 30 Liquamatte, designed for precision cleaning and finishing operations involving small parts lifted and handled manually, described in illustrated Bulletin 93; gives complete specifications, typical applications. American Wheelabrator & Equipment Corp., 1182 S. Byrkit St., Mishawaka, Ind. **L-2-13**

Heaters

Illustrated, 60-page, 1954 edition of catalog on Calrod electric heaters and heating devices, GEC-1005E, gives information on applications, special features, installation and prices. Indexed by processes and application, also gives methods for determining power requirements and heat losses for many uses. General Electric Co., Schenectady 5, N.Y. **L-2-14**

Electronics Equipment

Brochure B-6093 presents a 16-page summary of equipment available for use in electronics industry; includes descriptions, applications and operating ranges, and important technical data. Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa. **L-2-15**

High Temperature Alloys

Bulletin No. 301 offers complete information on five grades of high temperature alloys; includes typical analysis, characteristics, applications, machining information, and forging instructions. Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa. **L-2-16**

Calculator

Pocket size slide rule calculator allows for quick determination of correct sprocket ratio to be used on chain drive for company's automatic roll feed punch presses; reverse side of calculator has a slide rule for determining weights of metal pieces from length, width and thickness. Wittek Mfg. Co., 4305-15 W. 24th Place, Chicago 23, Ill. **L-2-17**

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-155

Drive Controls

Complete line of automatic production controls available on Reeves variable speed drives are discussed in 24-page booklet G-537; covers eight types of controls, accompanied by schematic engineering tracings to show how they can be utilized to increase production; also outlines their uses in solving various problems involving control of tension, acceleration and deceleration, velocity synchronization of machines, etc. Reeves Pulley Co., Columbus, Ind.

L-2-18

Blast Cleaning

Comprehensive booklet No. 1500, "Blast Cleaning" offers extensive, nontechnical information on abrasive cleaning; discusses basic advantages of the process, an analysis of where this method can be used, and how it works. Covers types of surfaces to be cleaned, finishes required, time element and cost. Also deals with types of blast cleaning machines for specific uses, as well as abrasives for various jobs. Pangborn Corp., Hagerstown, Md.

L-2-19

Tangent Bending

Details of Bath tangent bending sequence presses are presented in 28-page completely illustrated catalog. Gives facts on construction, specifications and operations, and also outlines advantages of each of the four presses involved. Shows many domestic and industrial applications of this phase of metalworking. The Cyril Bath Co., Aurora & Solon Rds., Solon, Ohio.

L-2-20

Gages

Bulletin S-1 shows line of tools for precision measurement of internal dimensions, including dial bore gages, inside micrometers, internal thread comparators and groove width gages. Includes discussions of design features, special characteristics, dimensional drawings and tables and price lists. Rimat Tool Co., 21 W. Dayton St., Pasadena 2, Calif. L-2-21

Tool Steels

Details on company's four graphitic tool steels (Graph-Mo, Graph-Tung, Graph-Al and Graph-M.N.S.) presented in extensively illustrated brochure; data covers heat treating, physical properties and application information for each steel. Numerous tables and charts allow quick reference to important information. The Timken Roller Bearing Co., Steel and Tube Div., Canton 6, Ohio. L-2-22

Dies

Comprehensive 112-page die manual deals with press brake dies and special tooling; includes information on how to select dies for specific jobs, tonnages required etc., covering all commonly used types; well organized for convenient usage. Well illustrated with drawings and photos. Write directly to Verson Allsteel Press Co., 9336 S. Kenwood Ave., Chicago 19, Ill.

Surface Plates

Principal features and advantages of Taft-Peirce line of granite surface plates covered in Catalog No. 510; also includes tabulated specifications of large range of plate sizes. The Taft-Peirce Mfg. Co., Woonsocket, R.I.

L-2-23

Surface Grinding

Pamphlet describes complete line of 6 x 18 in. reciprocating table surface grinders with operating features, specifications and dimensions; illustrated to point out special features. Includes descriptions and pictures of accessories for use with the machines. Reid Brothers Co., Inc., Beverly, Mass.

L-2-24

Field Notes . . .

A grant of \$3,200 has been made by National Research Corp. Scientific Trust for the support of scientific research to Massachusetts Institute of Technology. It was made to Prof. Thomas K. Sherwood for the purpose of extending basic knowledge of mass transfer between phases and the exploration of reported "barrier" to vaporization at low pressures.

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Plans for the first International Atomic Congress have been formulated for the purpose of widening atomic energy uses for peace. Experts on the subject from 10 nations will convene at the University of Michigan campus June 20-25 to discuss present knowledge and future possibilities. The University and the American Institute of Chemical Engineers are sponsoring the meeting, with representatives of AEC and the State Department actively cooperating.

The program, "Peacetime Uses of Atomic Energy," will include papers on the work which have been cleared by AEC, and similarly cleared information from abroad.

corporate changes

As of the first of the year, Union Carbide Canada Ltd., subsidiary of Union Carbide and Carbon Corp., began operation of six companies: Bakelite Co. (Canada), Ltd., Canadian Railroad Service Co., Ltd., Carbide and Carbon Chemicals, Ltd., Dominion Oxygen Co., Ltd., Electro Metallurgical Co. of Canada, Ltd., and National Carbon Ltd.

All will be operated as Divisions of Union Carbide Canada.

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Arrangements have now been finalized for the purchase of Kaiser for investment of \$16¼-million par value of a series of convertible preferred stock from Kaiser Aluminum & Chemical Corp., and 100,000 shares of common stock from the founding stockholders of that company by Kennecott Copper Corp.

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Negotiations have been reported under way for the purchase of the physical assets of Manistee Iron Works by Michigan Tool Co. According to the announcement of the move, the purchasing company will acquire the name, good will and business of Manistee Iron Works including the right to manufacture and sell all present products of the company. At the moment, the Manistee plant is being operated by Michigan Tool as the lessee.

Control of the Ductile Iron Foundry, Inc., of Stratford Conn., has been acquired by the Hartford Electric Steel Co. According to report, more than \$60,000 is being spent to install pit type annealing furnaces cleaning and inspection facilities and control devices.

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Entry into the commercial electronics field by Thompson Products, Inc., will come with that company's purchase of Bell Sound Systems, manufacturers of sound production equipment. According

to the announcement from Thompson, the Columbus firm will retain its identity and operate as a wholly-owned subsidiary. Its founder, Floyd W. Bell, will remain in a promotional capacity, while William M. Jones, Thompson's electronics division manager, will be overall director.

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Gun drill manufacturing operations of Conner Tool & Cutter Co., of Detroit, have been purchased by Madison Industries, Inc., Big Rapids, Mich. This transfer now makes it possible for an original equipment maker to offer accumulated knowledge in boring deep, large or small diameter holes.

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As of the close of business in 1953, Dynamic Corp., Kenosha, Wis., became a division of Eaton Mfg. Co. of Cleveland. Prior to this time, the Wisconsin firm, which was acquired by Eaton in 1946, has been operated as a subsidiary. Operations will continue with F. L. Hopf as general manager of the plant which now is designated as the Dynamic Div. of Eaton.

expansions

Construction of a new plant for Landis Machine Co., currently being completed at Waynesboro, Pa., represents an investment of about a quarter-of-a-million dollars. The facility will be devoted to the production of the line the company's line of collapsible and solid adjustable taps. It will increase present office and manufacturing areas by more than 60 percent.

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Opening of a Cincinnati office has been announced by Sipi Metals Corp. as part of its expansion program. A complete stock of non-ferrous alloys will be maintained there. Joseph H. Homan has been made district manager in charge of the office.

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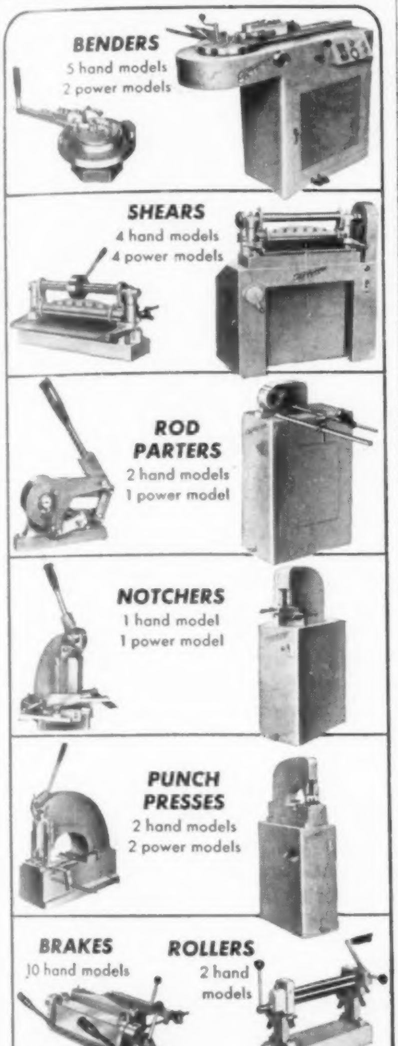
E. W. Bliss Co. has completed arrangements for the 10-year lease of a 62,500-sq-ft factory at San Jose, Calif. At present, the plant is equipped to manufacture and repair all Bliss products except the largest metalworking presses and rolling mills. According to Bliss president, Howard U. Herrick, plans for the San Jose facility include the manufacture of their general line of machinery. At the same



time, it will maintain a supply of standard parts to permit carrying on extensive repair service. It also will stock standard die sets and supplies made and distributed by Bliss subsidiary The Die Supply Co.

Establishment of the California plant is aimed at enabling the company to improve service to the western metalworking industry.

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More than double the area of its former plant and twice the machining capacity have been provided for Cadillac Gage Co. with the completion of its new modern plant at 25760 Groesbeck Hwy, Detroit, Mich. Among the main features of the facility are the inspection rooms with completely automatic temperature control. In addition, the increased space has made room for the addition of a new department providing precision chrome plating facilities.

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Completion of a $1,400,000 modernization and expansion program in the Ithaca, N.Y. power transmission chain manufacturing plant of the Morse Chain Co. has been announced by F. M. Hawley, president of the Borg Warner industry. All foundry facilities at the Ithaca plant are being abandoned because of decreased industrial demand for cast iron sprockets, Mr. Hawley explained, and Morse will now buy sprocket castings from outside sources. Its 75,000 sq ft iron foundry has been converted to a punch press and heat treating plant, while a large covered addition with railroad siding has been built onto the former foundry building to provide steel storage facilities.

warehouse and storage

Opening of a new warehouse in Rockford, Ill., by Udylite Corp., has been announced by L. J. George, Chicago district manager. Located at 310 Market St., it will be under the supervision of David B. Stockton.

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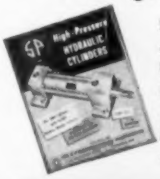
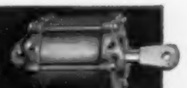
Recent announcement has been made of a warehouse at 12800 Puritan Ave., Detroit, Mich. to stock the line of fixed gages made by Sheffield Corp. in addition to all of the products of Threadwell Tap and Die Co., Sheffield's wholly owned subsidiary. The facility, which is operated as Sheffield Threadwell Sales Corp., is under the direction of





Charles O. Cromwell. At present service is extended to Wayne, Oakland and Macomb counties, which make up the Greater Detroit area; although eventual goal includes the service to all of Michigan and Northern Ohio.

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Some 500 guests, mainly tool and die steel users, attended the open-house at Latrobe Steel Co. to help celebrate the opening of the company's steel warehouse at 741 Ramsey Ave., Hillside, N. J. The facility, designed to serve users in Northern New Jersey, Greater New York and the Hudson River Valley areas, replaces the former sales office in New York City. It will maintain an assortment of tool steels, with stock replaceable through its own truck fleet, operating to and from the mill on schedule.

new quarters

Move from its former location in Milwaukee to a new and much larger plant at 500 S. 88th St. has been announced by the Joseph T. Ryerson & Son, Inc. The new facility provides four times the capacity of the old plant which the firm occupied since 1925.

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The Los Angeles branch office of Pratt & Whitney, Div. of Niles-Bement-Pond Co., has been relocated in new larger quarters at 3016 E. Olympic Blvd. This office will carry a more comprehensive stock of its company's regularly listed cutting tools and gages, as well as providing added office area for sales and service personnel.

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Open house marked the Pines Engineering Co., Inc., move into its new plant at Aurora, Ill. More than 400 engineering and production executives inspected the modern equipment for production bending, and precision metal-cutting and fabricating. The plant, covering 70,000 sq ft, represents a 50 percent increase since 1950. Among other improvements displayed at the open house was the new Pines 20-ton tube and pipe bending press for handling a much broader range of multiple bends with a single tooling setup.

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Early this year the Chambersburg Engineering Co., Chambersburg, Pa., will be able to occupy its new administration building. With its completion will come more space for all its departments including administration, sales, engineering, laboratory and storage.

AUTOMATION AT FORD

hinges on design, maintenance, management

Technical Digests

by G. G. Murie
Supervisor of Design
Engine Mfg. Engineering
Ford Motor Co.

New methods of automatic handling of parts between manufacturing operations at Ford originated in the need to reduce manufacturing costs, increase efficiency of machine tools, and improve quality of the product.

A new department was set up to concentrate on development of methods to solve these problems. Some early systems were worked out on a cut and try basis, as existing machinery and equipment had to be utilized, to justify cost studies.

Emphasis is now placed on proper and economical design. Simplicity and maintenance reduction are the keynotes of all automation planning, while cost savings is the underlying purpose.

For the production lines of a few years ago parts manufacturing was based upon a series of individual machine tools to perform the operations in small steps with manual handling between machines. Today, where possible, processing engineers plan a combination of similar operations to be performed on a part in one continuous machine with automatic indexing between work stations.

Transfer Machines

To illustrate the techniques used, consider the production of automotive crankshafts. One portion of the machining process involved drilling six oil holes, six metering holes, six lightening holes and inspection of the operation. Ten years ago twenty-nine separate machines would have been required. Today the same department requires only three transfer type machines of eight stations each. The part is loaded at one end and unloaded at the other end with all operations in between being completely automatic. This applies to other operations such as milling, broaching, reaming and tapping.

Such machine tools, known as transfer machines cause profound changes on our entire production process. Manpower must be redistributed to handle new sets of problems. A fresh view is required of methods of maintaining machinery elements and in applying tools to the job. Production lines in many cases are made up of groups of transfer machines that are completely automatic in themselves and must be coupled together by automation to gain the full potential benefits.

Development

The early automotive assembly line was, in a sense, the start of automation. The original chassis assembly line was utilized when Henry Ford introduced the idea of rolling the chassis along a route with operators and stock spaced along it.

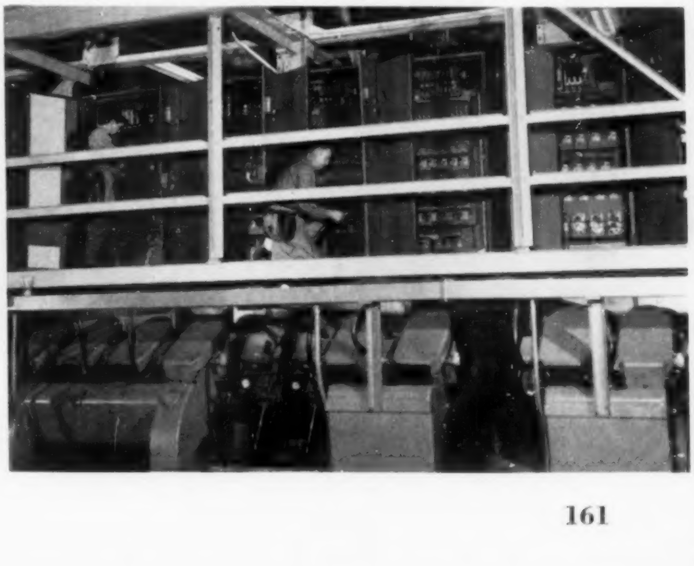
From this point, the moving chain conveyor developed and the operator was free to spend all of his time on assembly operations.

The conveyor became a symbol of mass production and was installed to perform many operations such as storage of materials, delivery to the line and for assembly operations to move the part past the worker.

Automation, as a separate and distinct function of manufacturing engineering, is a development of the last decade. The word was coined by Mr. D. S. Harder, Vice President Manufacturing, Ford Motor Company. The

Overhead monorail system for engine assembly is extension of conveyor-line idea, carrying through to shipping.

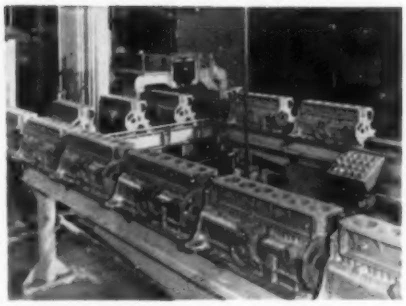
Inline machine tool drills crankshaft in progressive station operation. Central power panel is above.



word, like material handling engineering, has received proper emphasis since general acceptance. Its meaning is the automatic handling of parts through manufacturing processes.

Elements

It usually consists of one or a group of devices located in such a manner as to remove the parts from the unload station of a piece of process equipment or machinery in a certain position.



Engine blocks are automatically ejected upon transfer equipment from broaching machine. Automation shuttle positions them for next operation.

transfer and load into loading station of next machine; it may also rotate, turn or tilt the part in any required position to properly load the following piece of equipment.

A group of devices is usually necessary when the amount of machines required for one operation differs from that of the following operation. In this case, an electric control panel is usually required to properly synchronize all movements. In any event, the automation is interlocked electrically so that no loading or unloading takes place while the machine elements are going through their cycles.

Automation may also include necessary devices to dump chips and scrap

Crankshaft lathe is automatic in operation even to chip removal through sluiceway in floor.

pieces from the part automatically, or may be required to tilt the part for a short time to drain off coolant oil so that it will not be carried into the equipment of the following operations.

Pros and Cons

A wide variety of materials can be handled with substantial savings and at the same time eliminate dangerous handling, such as in large stampings, heat treat operations and forging operations. In many respects automation is the extended usage of conveyors which played such an important part in the early development of mass production.

In addition to other benefits automation permits a machine to operate closer to its design capacity. Using high cost machinery to a greater degree is, of course, a definite advantage. In some press lines it was impossible to load presses fast enough by hand to keep them running continuously. Automation makes it possible to do this on many machines. The connection of all elements of a production process for an over-all synchronization has been accomplished on many

machine lines. A secondary gain has been reduction of damage caused by parts hitting each other or falling to the floor. Increased safety has resulted due to elimination of hazardous handling of large stampings, engine parts and hot items such as forgings and parts in heat treat operations. Working conditions have improved by the reduction of manpower fatigue to employees since decisions are made by the control

Floor pans are transferred by automatic conveyors, loaders and unloaders through series of press operations from forming, piercing, trimming, restriking and flanging.

panel and actual labor is done by mechanical devices.

Use of automation devices in production processes naturally causes maintenance problems, which could offset the savings to be made, if improperly handled. Many departments have become nearly 100 percent automatic. The maintenance problem has been minimized as skill in automation design has grown. Many devices have been made more substantial and preventive maintenance has become a must.

Engineering costs are especially important here because of the need for coordinating so many elements, such as plant layout, processing, tool and die design, material handling and machine tool design.

Installation costs are another problem. Proper planning arranges installation of automation devices to occur at model change time when rearrangements are often necessary due to changes in processing.

Management

The factory with automation which now exists in important segments, represents a maturity of manufacturing methods. This maturity, that is accomplished by the utilization of the best of engineering thinking, has coincided with the greater utilization of specialists throughout the manpower structure of the plants. This, of course, means a larger number of individual departments working on the development and operation of new facilities.

This combination of factors places a new emphasis on management of factories. The top management of plants must be able to promote teamwork in the entire organization so that all phases of production planning will be coordinated. Plant management must keep itself flexible to make the best out of the various technical skills available.

From a paper presented at a Nov. 1953 Branch Meeting of the National Metal Trades Association, New York City.

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Use of Cutting Oils

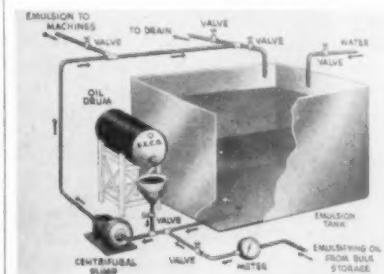
by Alan B. Myler
Sun Oil Company
Philadelphia, Pa.

As the speed of machining increases, so does the heat generated. In some cases, particularly on automatic screw machines, it has become too great for practical operation with straight cutting oils. This, and economic reasons, have created one of the modern trends in the use of cutting oils, namely, the increased use of emulsions as cutting fluids on automatic screw machines.

In general, emulsions are best suited for applications where there are long production runs on mild to medium steels. They may also be successfully used on steels which are difficult to machine, provided the operations are relatively simple and do not involve threading or tapping. Emulsions are least suitable for job shop work, where runs are short and where the cutting fluid must take care of a wide range of machining operations on a variety of different steels.

When a decision has been made to use emulsions on a machine or group of machines, then the lubrication engineer must see to it that proper facilities are installed. Most important is to have either a central system or a central mixing tank of adequate size, equipped to mix and supply an ample quantity of well-made emulsion.

The system illustrated is practical and successful, and may be readily constructed. The centrifugal pump is used



Mixing and storage tank for cutting and grinding oil emulsions.

both to mix the emulsion and to pump the emulsion to the machines. Other excellent systems and equipment are available for purchase from a number of sources.

While an adequate supply of a well-made emulsion of uniform concentration is the main requisite for satisfactory operation, there are other problems to be anticipated and taken care of.

The first is to prevent excessive leakage of lubricating oil into the cutting emulsion and vice versa. Oil seals on the machines must be carefully maintained. It may be impossible to completely stop leakage. Lubricating oil in reasonable quantities will float on top of the emulsion in the machines and be removed with the chips. Emulsions which leak into the lubricating sumps, however, should not be allowed to accumulate, but should be removed at regular intervals. The bottom of the lubricating oil sump can be exhausted of emulsion with a hand pump when machines are started after a shut-down.

Where excessive leakage cannot be controlled by oil seals, the use of a mist lubrication system might well be

investigated.

Another item of preventive maintenance in using emulsions is to be sure turret slides and cross slides are lubricated with a water-proof grease. It acts as a seal to prevent emulsion from washing abrasive dirt under the slides.

While the use of emulsions on automatic screw machines does present a few problems, none is insurmountable. Use of emulsions permits economy in operation and may allow material increases in machine speeds.

Another trend in cutting oils is the growing use of heavy-duty emulsifying cutting oils. A heavy-duty emulsifying oil is simply a regular emulsifying oil which has been blended with extreme pressure additives. This is usually in the form of a sulphurized fatty oil, but other types of sulphur or chlorine compounds may also be used.

The field of application for a heavy-duty emulsifying oil is for work too tough for a regular emulsifying oil, and too hot for the use of a straight cutting oil. Heavy cuts on tough steels with alloy steel or high-speed tools are typical. Where carbide tipped tools are used, the use of a heavy-duty emulsion is rarely necessary. Threading and tapping operations on mild or medium steels are good applications for heavy-duty emulsions. This field includes work on many types of bolts and nuts, fuse components and other ordnance parts.

A specification for cutting oils should include an emulsion stability test, and a corrosion test to make sure that the oil does not contain corrosive chemical additives. It should also specify an extreme pressure test on a recognized film strength testing machine. The film strength of a heavy-duty emulsifying oil (in a 10-percent emulsion) should be at least twice that of a regular emulsifying oil under the same test conditions.

In recent years, it is in the field of nonemulsifying cutting oils that greatest changes have been made.

Modern cutting oils are more economical. Lower but more efficient additive content tends to keep the cost down, and free flowing, transparent properties reduce consumption materially. They have better operator acceptance because of light color and lack of odor. A low additive content implies that they are more hygienic and less corrosive to metals. Management men find these new oils keep tools and work cooler because of more efficient cooling and lubricating properties. These factors permit an increase in rate of production.

From a paper presented at the 1953 Annual Meeting of the *American Society of Lubrication Engineers*.

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Technical Digests . . .

Preparing New Materials for Production

by **Howard W. Benjamin**
Lockheed Aircraft Corp.,
Burbank, Calif.

To obtain basic fabrication data on a new material before releasing for design and production requires an orderly procedure for examination of the material by standard basic tests and the transmittal of experimental data to the engineering and manufacturing groups.

During the past 20 years the aircraft industry has been the focal point for many new metallic materials as well as new plastics, ceramics, adhesives, variations in glass, and many other combinations of materials.

As a result of unfortunate experiences in the past the designer today realizes that the producibility and serviceability of a new material is equally as important as initial weightsaving and structural advantages claimed by the producer. The management of the aircraft plants realize that it costs money to put a new material into production and are willing, in general, to finance their share of a sound program to investigate thoroughly the structural and producibility aspects of the material.

A complete analysis of a new metallic material today includes the lab work necessary to prove producers' claims and furnish the additional information on properties required by the structures and methods development groups. Design criteria on which to base a structural analysis is not enough for the designer as he must have complete data on formability, weldability, and machinability in order to design for production.

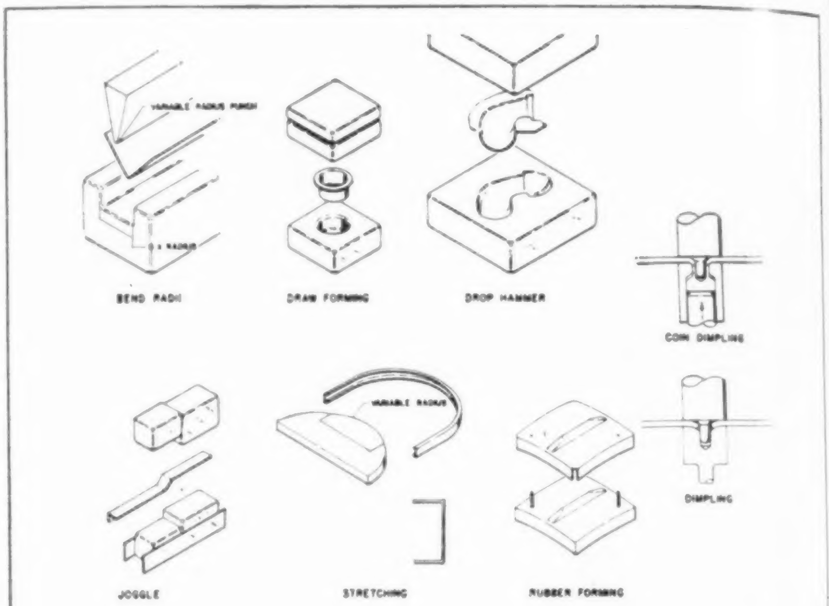


Fig. 1. A variety of forming tests must be performed to give sufficient information for adopting a new material to production.

Physical Properties: A spot check is made of available producer data in regard to physical, chemical, and temperature properties to satisfy basic design needs. Additional testing must be continued to develop complete design criteria.

Fabrication Machining Tests: Samples of a new material are put through the following conventional machining operations: (1) cutting, such as (a) slab milling, (b) straddle milling, (c) end milling, (d) slotting, (e) turning, (f) boring and threading; (2) Drilling; (3) Reaming; (4) Tapping; (5) Grinding. On each of the above operations data is obtained for comparison with standard materials.

Part costs are an important consideration and can be analyzed by comparative floor-to-floor time on any of the machine operations. Tool life compared with other materials becomes a part of machining costs. If conventional tools will not cut a new material special tools must be checked and their costs noted for each operation in which they are required. The effect of machining a material is checked by evaluating the percentage of rejections caused by machining, such as warpage, surface cracks and any other ill effects that will cause scrapage of the part, added surface treatments or straightening.

Forming Tests: Standard forming

tests as illustrated in *Fig.* 1 give comparative data to other known materials. 1. Bending on a standard brake tool with varying radii gives data on minimum bend radii. The width of the lower die is eight times the punch radius. 2. Joggling of angle sections of varying depths and transition lengths both hot and cold produces comparative joggle data with other materials tested. 3. Drawing is demonstrated by the use of a standard cupping die. All samples are gridded for measurement of the variations in elongation after drawing. Maximum draw depth is obtained for a depth to diameter ratio. 4. Stretching over a standard die with varying radii inserts produces data for elongation with grain and cross grain. 5. Drop-hammer parts evaluate complex forming characteristics. Parts can be formed at elevated temperatures, if necessary, to obtain best results. A grid is used to measure shrink and stretch areas. 6. Rubber forming on a standard die with a one-inch flange checks adaptability of the material to withstand a ten percent stretch and eight percent shrink. 7. Dimpled shapes and quality are checked with conventional and coin dimpling both hot and cold. The pressure, dwell time and temperature are noted and compared with other similar materials.

WELDING: Spotwelding integrity is tested by using single spot shear and tension tests. Flashwelding specimens are prepared using tubing, bar, or plate stock. Tension and bend tests are used to check physical properties. Fusion welding is checked for applications to the new material by producing panel-type specimens utilizing a particular welding method. Testing of the weld area and affected area must be thoroughly analyzed by pull and bend tests as well as metallurgical examinations.

FORGING: Comparative forging data to standard materials is obtained. The evaluation of metal movement will show the necessity for variations from standard forging techniques. The number of stages required to forge a part is an economical consideration. Metallurgical examination of cross sections for quality shows up cold shuts, tearing, laps and other imperfections.

CASTINGS: When a new casting material is introduced, considerable coordination is required between the user, the foundry, and the producer to develop casting specifications in regard to the strength of the material and its limitations for section thickness, flow of the materials, and other data required for design criteria.

PROCESSING: Sufficient laboratory tests must be run on a material to prove

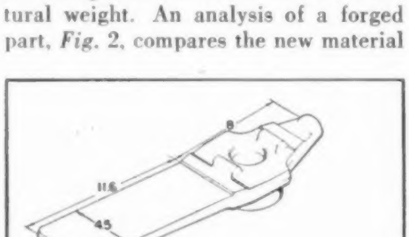
its adaptability to standard processing operations such as: (1) heat-treatment, (2) cleaning, descaling, etc., (3) surface finishes, (4) metallic and nonmetallic coatings. If standard processing operations are not suitable for the material additional investigations are required.

QUALITY CONTROL: Inspection techniques to maintain quality-control standards are investigated and recommendations made as to the type of material inspection required. Inspection tools such as X-ray, Magnaflux, Zyglo, Dy-check, etc. are examined and if applicable, inspections standards are established.

When present inspection techniques are not sufficient to maintain quality control new equipment and techniques must be designed and developed.

COST CONSIDERATIONS: Raw material costs and estimated production costs are important data obtained from the standard basic tests. It is natural to assume that the cost of the material will be reduced when production quantities are increased and the fabrication costs reduced with experience. The material producer can project the cost of the material to a point of anticipated usage and the aircraft manufacturer can project productions costs by means of learning curves to a corresponding production quantity.

A recently introduced material offers an example of the cost to reduce structural weight. An analysis of a forged part, *Fig.* 2, compares the new material



TIP TANK SUPPORT

DESCRIPTION	8630 STEEL (ACTUAL)	NEW MATERIAL PRODUCERS DATA	NEW MATERIAL DATA FROM BASIC TESTS
COST OF FORGING STOCK	$ 0.10/LB.	$ 10.00/LB.	$ 13.00/LB.
MAT'L. COST/ FORGING	$ 6.00	$ 195.00	$ 254.00
FORGING COST/ PART	$ 1.90	$ 5.70	$ 10.00
TOTAL COST OF FORGING	$ 7.90	$ 200.70	$ 264.00
MACHINING COST / PART	$ 130.00	$ 390.00	$ 500.00
TOTAL COST OF FINISHED PART	$ 137.90	$ 590.70	$ 764.00
WEIGHT SAVED PER PART		5.9 LBS.	5.9 LBS.
COST PER LB. OF WT. SAVED		$ 100.12	$ 129.50

Fig. 2. Forging Costs Analysis

to steel which it could replace at a substantial weight reduction. The difference shown in the preliminary machining costs given by the producer and the actual machining costs proven during the standard tests, highlights a costly item that cannot be reduced without developing a new method for removing metal or developing a new alloy that can be more easily machined.

METHOD CONSIDERATIONS: The best of new materials has no value to the airplane manufacturer unless methods are developed for producing finished parts either on existing or on new equipment. Each new material requires extensive methods development work, not only to machine, forge, cast, form, or extrude the material, but also to adapt present equipment or design new equipment to do these operations.

PILOT LINE: On completion of the basic tests and cost considerations, it is advantageous to select a production part for a pilot line operation. In order to obtain the best comparative analysis it is desirable to select a part from production of a similar material on which all operations have been checked for labor and material costs.

TRANSMITTAL OF DATA: During the testing for basic data it is of the utmost importance that a smooth flow of information, as it becomes available, be transmitted to design engineers, structural engineers, and to the manufacturing organizations. The flow of information as shown in *Fig.* 3 has proved to be an orderly method covering preliminary

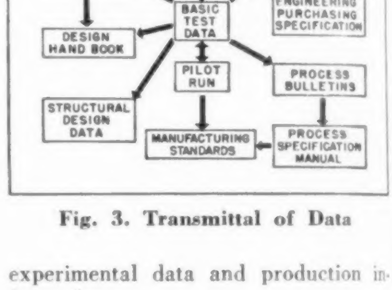


Fig. 3. Transmittal of Data

experimental data and production information.

From a paper presented at the ASME Semi-Annual Meeting, Los Angeles, Calif., 1953.

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Organizing for Production Engineering

by R. H. McCarthy
Western Electric Co., Inc., Kearney, New Jersey

Much of the skill of solving problems is in selecting and stating the key points accurately. Often in doing so the appropriate organization of production engineering efforts becomes evident. For better definition, the following will be cut away from the direct problems of production engineers: general industrial accounting and financing; basic research; product development and design; distribution; advertising; public and industrial relations; plant maintenance and protection; and supervision of productive personnel. This leaves a group of prob-

lems that require production engineering. They commonly appear in the portions of the steps of an industrial project that are shown in *Fig.* 1.

This group calls for a wide diversity of talents applied neither to the use of the product nor to the supervision of people who make it, but to problems of how to make it. The people who work

Fig. 1. Steps of an Industrial Project

1. Research
2. Development
3. Model construction
4. Model trial
5. Manufacturing review
6. Preliminary cost estimate
7. Design
8. Trial installation
9. Final design, specification and first issue of drawing
10. Manufacturing analysis
11. Rating of job as to personnel
12. Material handling analysis
13. Facility analysis
14. Facility design
15. Final cost estimate
16. Facility procurement and installation
17. Tool-made sample review, approval
18. Job rating analysis
19. Wage incentive analysis
20. Quality assurance planning
21. Production programming
22. Piece parts production and test
23. Subassemblies production and test
24. Final assembly production and test
25. Inspection
26. Packing and shipping

on this group of problems must understand the product, its use, and the need to hold down costs. They must knw processes and how to design the tools, machines and factories that make the processes possible. They must cement product design to manufacturing processes with wise application of economics and human skills. The problems are in the field of engineering and can be solved by engineering methods. Whether the people solving these problems are called production engineers, manufacturing engineers, or industrial engineers, is unimportant.

Responsibilities of Product Designers

Under good design specification practices, few question concerning product performance remain in an uncertain zone between the designer, the manu-

facturer and the user. Such expressions as "good commercial practice," "high quality," "running fits," "free from blemishes and defects," "good workmanship," and so on, appear less frequently in favor of clear-cut specifications. Few products have behind them perfection in this matter of isolating design responsibility, yet the possibility of defining it exists and the practice is growing.

Responsibilities of Production Engineers

The more clearly the responsibility of the product designer is defined, the more clearly does the responsibility of the manufacturer stand out. First, he must understand the design, then he must accept the design as possible of manufacture. He must provide materials, facilities and personnel that can make products which meet all requirements of the design. He must manufacture at lowest possible costs. He must ship only those products that meet design requirements. These prerequisites have a number of engineering aspects that can be readily identified. That the aspects shown in *Fig.* 2 are

Fig. 2. Responsibilities of a Production Engineering Organization

1. Assistance to designers in development of product.
2. Preparation of preliminary cost estimates.
3. Continuing liaison with product designers.
4. Interpretation and transmission of product design information to all manufacturing activities.
5. Control of purchased material specifications.
6. Designation of processes and detailed steps by which product is to be made.
7. Development of new processes and methods when required.
8. Determination of kind and amount of facilities required.
9. Design and provision of facilities required.
10. Development and designation of inspection methods.
11. Rating of job as to personnel skills required.
12. Shop assistance in manufacturing difficulties.
13. Final estimates of new products' costs.
14. Continuing cost reduction by suggesting product design changes and by introducing better facilities, processes and combinations of skills.

suitable problems for the engineering profession has common acceptance. This chart simply expands the middle group of steps shown in the previous chart.

From these responsibilities others are implied. For example, items 6 through 9 directly imply responsibility for the safety of methods and facilities. This requires experts in industrial hygiene and allows no sharing of responsibility for the safety of a process that has been specified unless there is misuse or abuse of materials and facilities. In the simplest terms, all fourteen items reduce to (1) design liaison, (2) prescription of manufacturing methods and processes, (3) provision of facilities, and (4) continuing cost reduction as the responsibilities of engineering for production.

Organization

From this background, comes the conclusion that the need for a profession of production engineers stems primarily from the separation of product design responsibilities from other responsibilities and from the demand for interchangeable, highly technical and exactly controlled products. The need for the profession stems only incidentally from the desire for lower cost. For the former need it is indispensable, for the latter it is desirable.

Rather than speculate on possibilities one manufacturer's organization will be described: the Engineer of Manufacture organization in the Manufacturing Division of the Western Electric Co., Inc., who make most of the communications apparatus and equipment used by the Bell System. A sample chart, *Fig.* 3, is shown rather than a breakdown giving specific products or all details of organization. Numerous other ways of arranging the work or of breaking the organization apart into a number of entirely separate organizations are possible. This one is presented and discussed because it is real and has been faced with many of the problems of production engineering.

The chart shows two kinds of engineering departments. The one that associates directly with a shop department is called a product engineering department. The other that gives routine or technical consulting service to the first kind is called a technical or general service department.

Each shop department looks to one product engineering department for all the manufacturing engineering service it requires. If the product engineering department does not originate the information, instruction, or facility upon which a specific need for service is based, it must get, approve and deliver

them. The product engineer works with the product designer to insure that the product can be made consistently with high quality and reasonable cost. He accepts or rejects the manufacturing aspects of the product design for the Manufacturing Division and becomes headquarters for the manufacturing drawings and specifications of it. He plans the coordination of human effort with tools, machines, power and factories. He lays out and records for the shop each step of production from piece part through assembly, test and inspection.

Fig. 3. Organization Chart

Labor Relations

Works Comptroller
- Cost Acctg. & Pricing
- Wage Incent. Bus. Method
- Acctg. & Payroll

Ind. Relations Mngr.
- Medical Service
- Public Relations
- Employee Serv.

Operating
- Shop A Optg. A1 (2)
  - Serv. A2 (3)
- Shop B Plt. Const. B1 (4)
  - T1 Const. B2 (3)
  - T.S. Const. B3 (6)
  - Insp. B4 (4)
- Eqt. Serv. I
  - Program Plan.
  - Install. Serv.
- Eqt. Serv. II
  - Stock Maint.
  - Warehousing
  - Customer Ser.
  - Traffic Agent

Works Purchasing

Works Eng of Mfg.
- E of M IV-1
  - Draft Serv.
  - Fact. Eng.
  - Bldg. Eng.
  - Const. Sched.
- E of M IV-2
  - Eng. Serv.
    - Prod. Eng.
    - Prod. Eng.
    - Prod. Eng.
    - Prod. Eng.
- E of M IV
  - E of M IV-3
    - Beng. Train.
    - Mech. Des.
    - P. & E. Lab.
    - R.M. Eng.
    - Insp. Dev.
    - Wage Pract.
  - E of M IV-4
    - Space Plan.
    - Mtl. Handl.
    - Mdse. Pack.
    - Mdse. Method

( ) = No. of depts. in div.

A single department of product engineers varying in size from five to twenty people cannot have experts in all the broad range of responsibilities given one works engineer of manufac-

ture. Therefore, a number of other departments of a service nature or of technical consultant calibre exist to provide general services or to concentrate specialized technical services where they may be available to all product engineers. Titles of the departments as they appear in *Fig.* 3 need little explanation. These departments of specialists are obligated to keep the product engineers informed of the best tools, machines, finishing methods, metal joining practices and general factory services available, and to design them as required. To insure this cooperation, all requisitions for manufacturing facilities, changes and rearrangements must have two kinds of approvals, one for expenditure, the other for design. Expenditure approvals come from the product engineering line of organization. Design approvals come from the specialists, such as the tool designers, test set designers, standard machine procurement department, factory engineers, and so on.

Measure of Effectiveness

As well chosen, as well grouped, and as well manned as any such broad organization of activities as those described may be, it is of little value unless it has the support of the other organizations in the enterprise.

Without responsibility for expenditures for plant facilities, the best of engineering plans, the most careful of economic studies and the most active cost reduction program are paper work. When the engineer has to make a reality of his planning by providing the facilities he has specified and then comparing actual costs with his cost estimates, a measure of production engineering effectiveness becomes possible.

From a paper presented at 1953 Semi-Annual Meeting American Society of Mechanical Engineers.

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Machining Integrally Stiffened Structures

by J. C. Borger
Production Methods Engineer,
Lockheed Aircraft Corp.

During the design-development stages of the integrally stiffened structure, consideration was given to the determination of optimum size of panel to be produced. Vendor limitations on thickness, width and length were based on alloy, maximum ingot size, capacity of rolling equipment, heat-treating furnaces and quenching tanks, straightening rolls or stretcher levelers, transportation facilities, and so on. During fabrication of the first experimental panels, both straightness of the material before machining and straightness of the part after machining pointed up that:

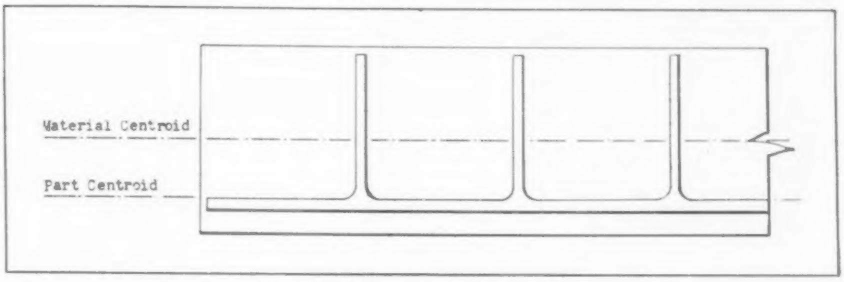

Fig. 1. Plate stock relationship.

1. Before machining, material must be relatively free from bows, reverse bends, crowns, and the like, to allow for proper holding and support during machining operations.
2. If during machining a part bows or warps excessively, such condition is attributable to high residual stresses which are released during removal of material; this condition necessitates use of relatively stress-free material; this in turn means careful control of straightening operation by the vendor.
3. If material is not entirely stress-free (and no such material has yet been

found), final longitudinal and transverse warping or bowing can be estimated generally and final effects somewhat modified by careful sequence of machining operations; this means basically removing material so that the centroid of the part is located as near to the centroid of the raw material as possible, *Fig.* 1.

Because available equipment was inadequate, it was necessary to design a machine specifically adapted to produce integrally stiffened structural parts. The final decision was to use a conventional planer-type milling machine equipped with three heads and with profiling mechanism for both horizontal and vertical movement. The result, the skin mill is a planer-type milling machine, 10 feet by 34 feet with milling heads arranged for profiling vertically and/or horizontally.

In designing this equipment, a great deal of effort was expended to make it completely universal so that it could handle any type of design. As a result, therefore, of specifications, many minor deficiencies have arisen that would not have been incurred in a single-purpose machine. The major difficulties encountered are a direct result of specified requirements and not necessarily because of poor construction. The machine tools now being used to produce integrally stiffened structure are not adequate because: feed rates are too slow; machines will not hold close tolerance; loading time is excessive; cam-changing and positioning are too slow and not accurate; machines have inadequate chip-disposal systems, they require excessive maintenance, do not provide for quick change and accurate cutter positioning and do not have adequate table-positioning equipment.

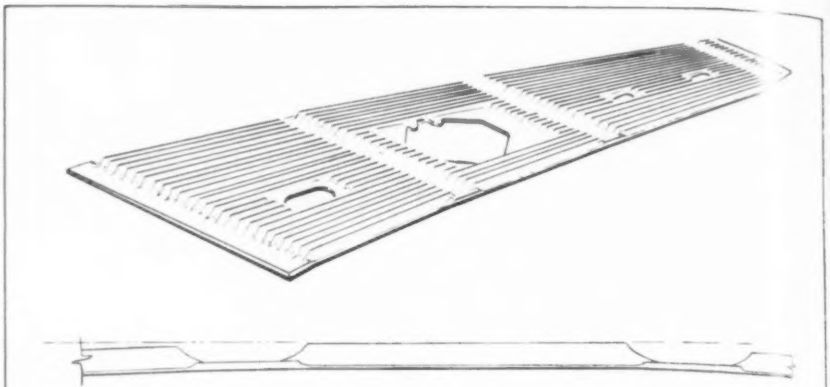

Fig. 2. Constellation machined skin.

Thus both material and machining factors are involved in producing these structures. If the material has too high residual stress and is warped, machining is impossible. If stress and warped conditions are slight, the panel may be machined—but a bowed or warped part will result, which requires extensive and costly forming operations. On the other hand, if material is reasonably free of residual stress and the machine cannot produce the part to reasonable tolerance, the part is overweight. On the Constellation panels, *Fig.* 2, machining for instance, 0.001-inch thickness amounts to approximately 10 lb. per airplane. Since tolerances must be on the plus side to preserve structural integrity, weight of present panels may vary in the order of 100 pounds per airplane.

From a paper presented at the 1953 Semi-Annual Meeting of ASME.

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Controlling Production Costs

by Phil Carroll
Professional Engineer
Maplewood, N. J.

Customers buy when they think the price is right. In most instances, one can sell more and more products as one reduces prices further. Henry Ford proved that by deliberately making a car for the multitudes. He made profits, therefore, he must have pushed down his costs.

Henry Ford knew his costs. He made one model. That could be any color one wanted as long as it was black. Hence, he was able to divide the total he spent by his total output and get his cost per car.

But most people can't figure their costs that way. They have several products, in several sizes, styles, and colors. That's why there are cost systems.

These systems give wrong answers. Labor and material are figured to the fourth decimal place. But overheads are spread with a shovel. As a result, several details of vital importance are out

on a thumb. Management doesn't know whether it makes or loses money. One can't find out whether people do "develop" and produce results. Management is unable to apply incentives to get people to cut costs.

Much stress is placed on budgets. Of course they are better than handing out blank checks. However, budgets apply to functions—not to products.

This discussion has pointed up three factors. First, manufacturers are fooling themselves with costs that are off. The errors are in misapplied overhead. The trouble is that they think in averages, and averages are wrong in multi-product plants.

Secondly, time-study men contribute to the muddle by including overhead in their so-called productive standards. This is a grave error. It is necessary to set up a sound denominator to gain control of costs.

Thirdly, industrial engineering efforts are limited to only part of shop operations. Obviously, it is necessary to complete the measure of productive work. More particularly, to separate all that is productive from the total so-called direct.

Move on to measure overhead after you are thinking straight on the first two points. Overhead is high and climbing. It gets worse with every advancement in management. You can help to solve this problem in three ways:

1. Study overhead operations. You will uncover the same kinds of wasted efforts you found in the shop, and you will be sure to find many ways to improve methods. Both will reduce costs.
2. Relate the operations you study to the products that cause them. Thus, you will help to break down your average overheads, and then your costs will be more correct. Equally important, your managements can make their decisions with more confidence and more accuracy.
3. Aim at proper incentives. You want correct standards and costs so as to measure results. You want better operations. You want better cost controls. To get these it is necessary to have better management. That means setting standards for people to work to and rewarding those who contribute. More and better incentives are needed. You should provide the urge for people to develop and to excel in managing their parts of industry. Remember, people spend your expenses. Only people can save them.

From a paper presented at the 1953 Time Study and Methods Conference, Society for Advancement of Management and ASME Management Div.

Who's Meeting - and Where

Feb. 3-5. SOCIETY OF PLASTICS INDUSTRY, INC. Ninth annual conference, reinforced plastics division. Edgewater Beach Hotel, Chicago. Complete details may be had from the society, 67 W. 44th St., New York 36, N.Y.

Feb. 5-6. AMERICAN SOCIETY FOR QUALITY CONTROL. Middle-Atlantic regional conference, Lord Baltimore hotel, Baltimore, Md. Write to the society, 70 E. 45th St., New York 17, N.Y., for more information.

Feb. 15-17. ASSOCIATION OF IRON & STEEL ENGINEERS. West Coast meeting, Hotel Statler, Los Angeles. Details are available from the offices, 1010 Empire Bldg., Pittsburgh 22, Pa.

Feb. 19-20. NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS. Spring meetings, Hilton Hotel, Albuquerque, N.M. Pertinent information obtainable from society offices, 1121 15th St., N.W., Washington 5, D.C.

Feb. 19-20. MACHINERY & ALLIED PRODUCTS INSTITUTE. Third session, seventh conference on capital goods economics, Statler Hotel, Washington, D.C. More details may be had from the headquarters, 1200 18th St. N.W., Washington, D.C.

Mar. 2-4. AMERICAN MACHINE TOOL DISTRIBUTORS ASSOCIATION. Spring meeting, Boca Raton, Fla. For details, write to association, 1900 Arch St., Philadelphia 3, Pa.

Mar. 4-5. AMERICAN SOCIETY FOR METALS. Spring meeting, Hotel Statler, Boston. For more facts write to society headquarters, 7301 Euclid Ave., Cleveland, Ohio.

Mar. 10-12. AMERICAN SOCIETY OF MECHANICAL ENGINEERS. International meeting, Mexico City, D.F., Mexico. Contact society office, 29 W. 39th St., New York, N.Y., for more details.

Mar. 15-19. NATIONAL ASSOCIATION OF CORROSION ENGINEERS. Annual conference and exhibition, Municipal Auditorium, Kansas City, Mo. Write for details to 1061 M & M Bldg., Houston 2, Texas.

Mar. [illegible]-17. Steel Founders' Society of America. Annual meeting, Edgewater Beach Hotel, Chicago. Society office, [illegible]0 Midland Bldg., Cleveland 15, Ohio, can supply more facts.

Mar. [illegible]-19. Pressed Metal Institute. Technical meeting and exhibition, Hotel Carter, Cleveland. Address institute headquarters, 2860 E. 130th St., Cleveland, Ohio for complete information.

Mar. 19-20. Machinery & Allied Products Institute. Fourth session, seventh conference on capital goods economics, The Greenbrier hotel, White Sulphur Springs, W. Va. For complete information, write 1200 18th St. N.W., Washington 6, D.C.

Mar. 24-Apr. 1. American Chemical Society. Spring meeting, Kansas City, Mo. Contact society headquarters, 1155 Sixteenth St. N.W., Washington 6, D.C., for all details.

Apr. 3-4. Packaging Machinery Manufacturers Institute. Spring meeting, Hotel Dennis, Atlantic City, N.J. Write to institute office, 342 Madison Ave., N.Y., for facts.

Apr. 5-6. Society of the Plastics Industry (Canada), Inc. Twelfth annual conference, Mount Royal Hotel, Montreal, Quebec, Canada. Society headquarters, 67 W. 44th St., New York 36, N.Y., can give details.

Apr. 5-7. American Society of Lubrication Engineers. Annual meeting and exhibition, Hotel Netherland Plaza, Cincinnati. For more information, contact society office, Western Society of Engineers Bldg., 84 E. Randolph St., Chicago 1, Ill.

Apr. 5-7. Metal Treating Institute. Spring Meeting, The Homestead, Hot Springs, Va. Address institute office, 271 N. Ave., New Rochelle, N.Y., for details.

Apr. 19-20. Stanford Research Institute. Joint sponsors with the United States Air Force of symposium on "Automatic Production of Electronic Equipment," Fairmont Hotel, San Francisco. Write to general chairman, L. K. Lee, head of Advanced Techniques Group, Engineering Div., Stanford Research Institute, Stanford, Calif., for complete information.

Apr. 26-30. American Society of Tool Engineers. Tool Engineers' Industrial Exposition, Convention Hall, Philadelphia, Pa., to be held concurrently with annual meeting, Benjamin Franklin and Bellevue Stratford Hotels.

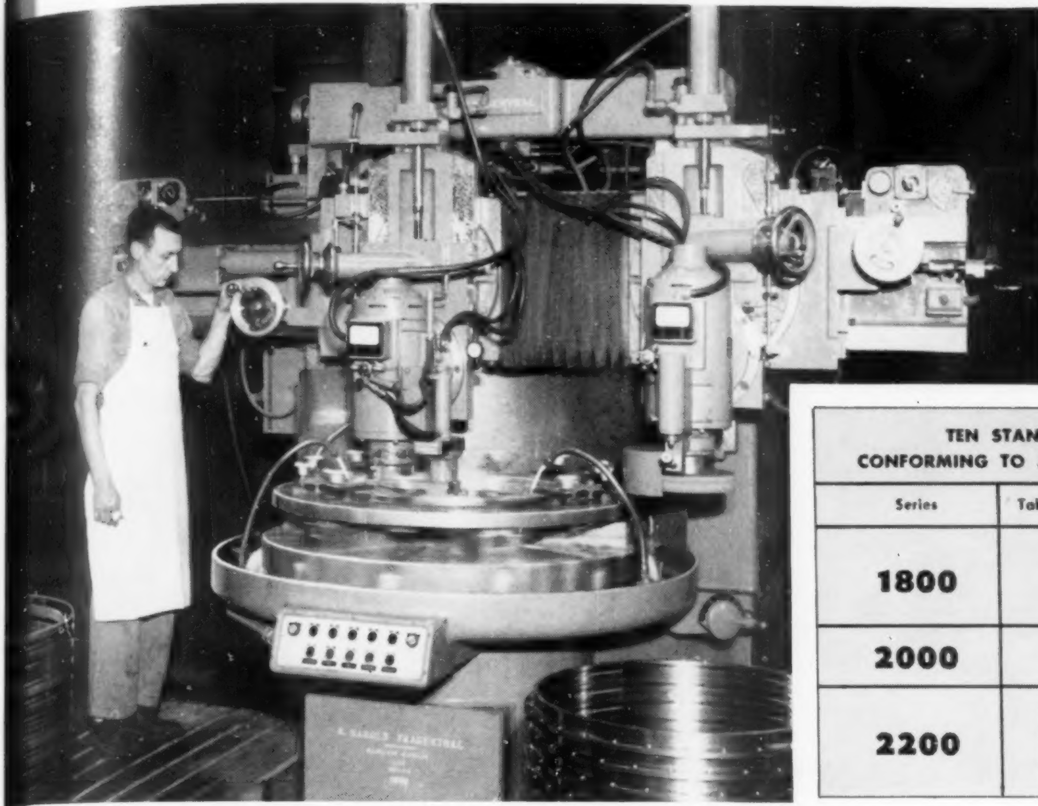

Photo shows 1800 Series Grinder finishing ultra-precision bearings.

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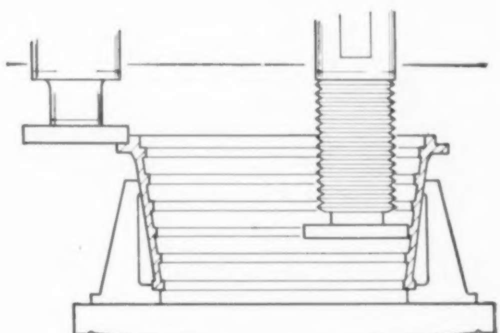
Series	Table Sizes	Maximum Swing
1800	30″ 36″ 42″ 48″	60″ 60″ 60″ 60″
2000	60″ 72″	72″ 88″
2200	110″ 120″ 130″ 140″	120″ 130″ 140″ 150″

NOW — on all your toolroom or production grinding, even on unusually large work—you can get the advantages of Frauenthal "millionths-of-an-inch" precision at no more than it would cost you for less accurate grinding.

With a Frauenthal Grinder, you can easily hold tolerances within two tenths . . . to dimensions best expressed in millionths of an inch . . . on unusually large work where it was previously impossible to approach this kind of accuracy. This capacity . . . and the ability to maintain exacting tolerances on production schedules . . . is primarily due to two factors: (1) the Frauenthal vertical grinding principle, and (2) the ultra-precision with which each grinder component is built.

With a single setup, Frauenthal grinders allow you to simultaneously grind related *bores* and *O.D's. round* and *straight*, to uniform accuracy within two hundred millionths! Furthermore you can precision-grind related *faces, flat* and *square*, or *perpendicular*, or at *angles*, to such accuracies.



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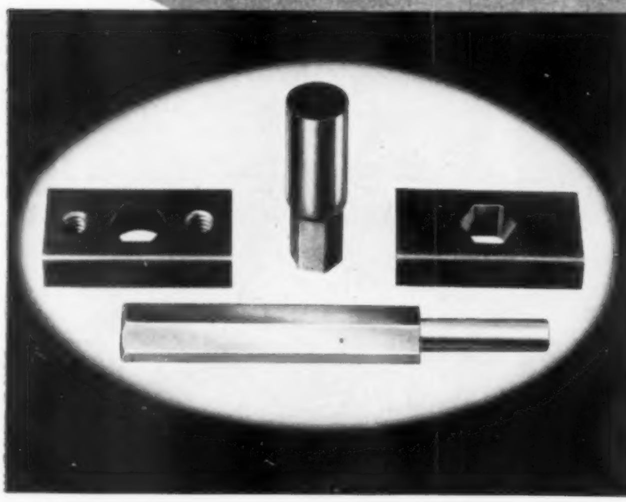
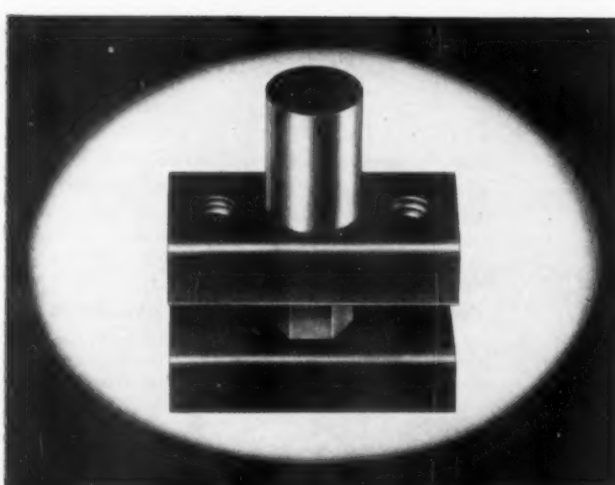
Can You Make This Punch, Die and Stripper Plate Out of Tungsten Carbide for



\$35.50*



In Your Plant

*

Electrode manufacturing time	2 hours
Cutting time on die	½ hour
Cutting time on stripper	½ hour
Cutting time on punch	½ hour
Accumulated setup time	1 hour
TOTAL LABOR TIME:	4½ Hours
Cost of Tungsten Carbide material:	\$22.00

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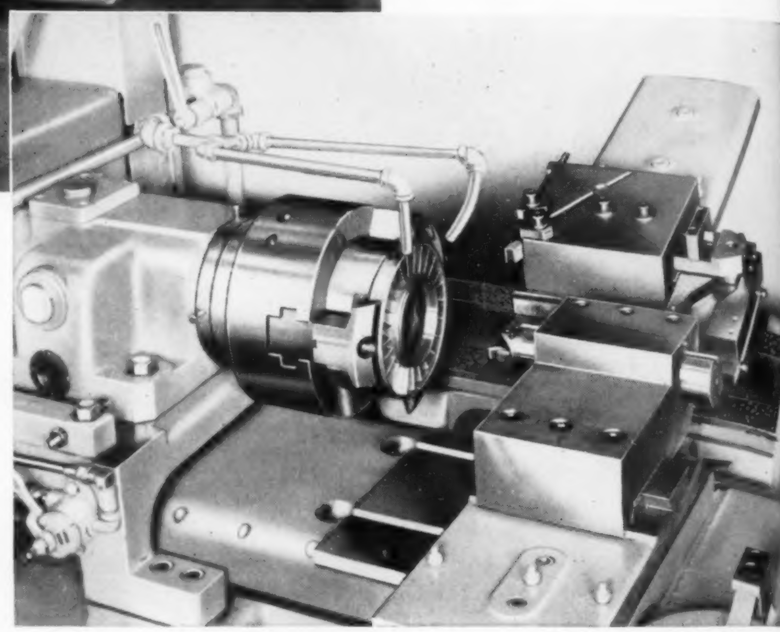
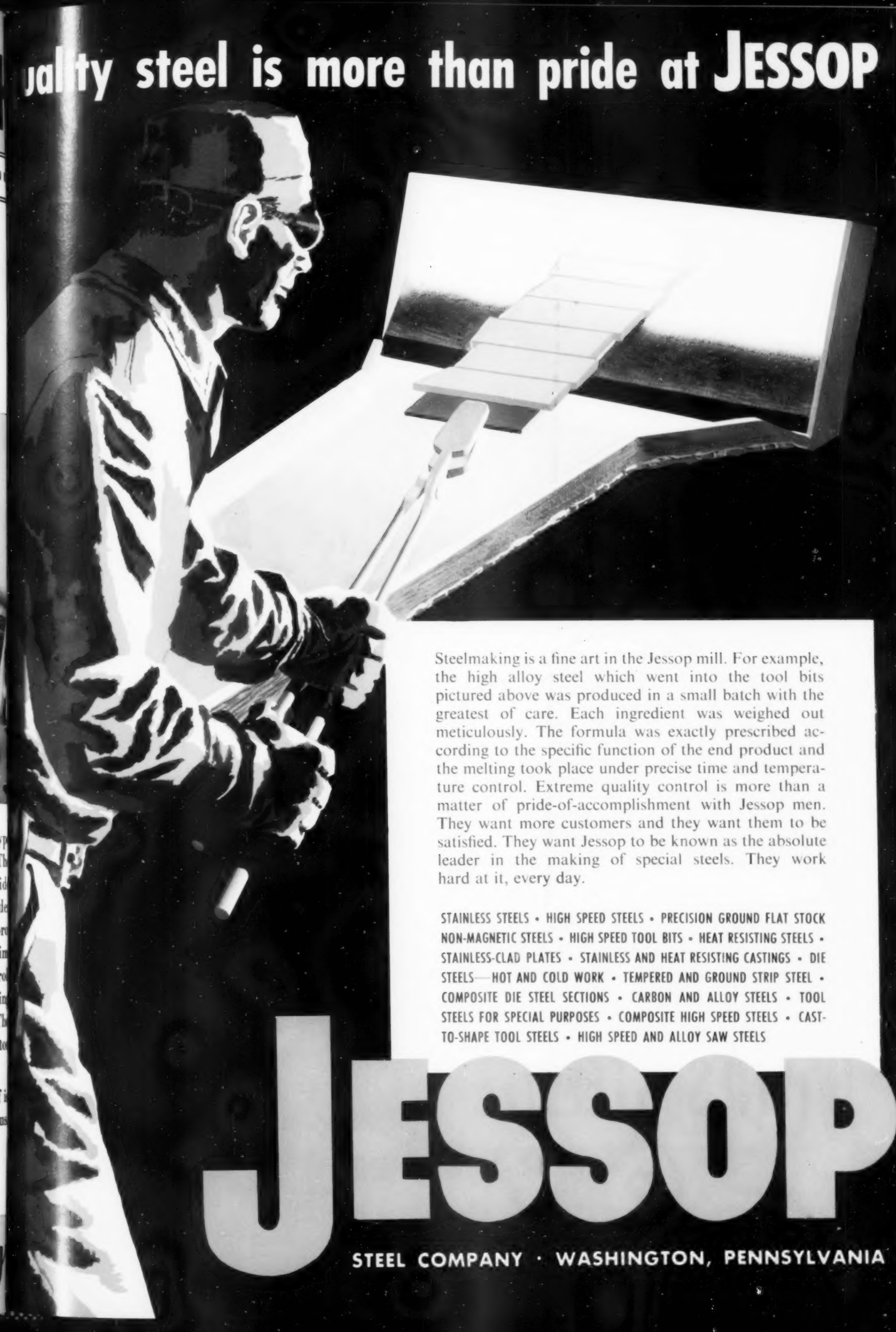
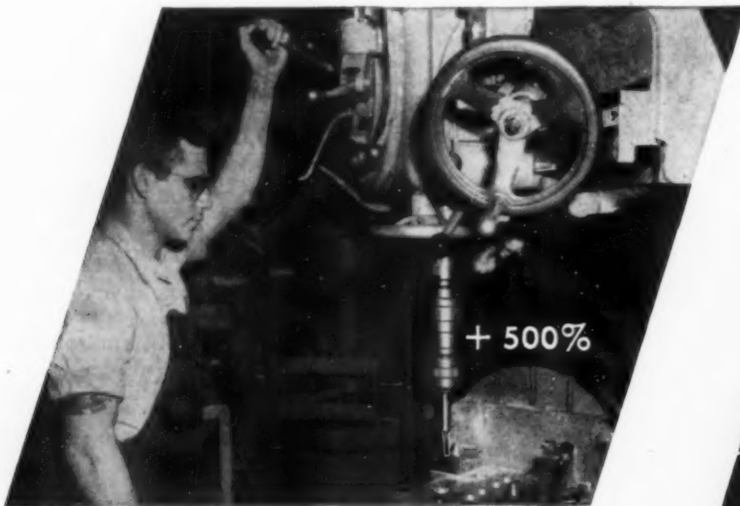
Left: Several of a group of Lo-swing IMP's used in machining Automatic Transmission Parts.

Below: Close-up view of tooling.




uality steel is more than pride at JESSOP
Steelmaking is a fine art in the Jessop mill. For example, the high alloy steel which went into the tool bits pictured above was produced in a small batch with the greatest of care. Each ingredient was weighed out meticulously. The formula was exactly prescribed according to the specific function of the end product and the melting took place under precise time and temperature control. Extreme quality control is more than a matter of pride-of-accomplishment with Jessop men. They want more customers and they want them to be satisfied. They want Jessop to be known as the absolute leader in the making of special steels. They work hard at it, every day.
STAINLESS STEELS • HIGH SPEED STEELS • PRECISION GROUND FLAT STOCK NON-MAGNETIC STEELS • HIGH SPEED TOOL BITS • HEAT RESISTING STEELS • STAINLESS-CLAD PLATES • STAINLESS AND HEAT RESISTING CASTINGS • DIE STEELS—HOT AND COLD WORK • TEMPERED AND GROUND STRIP STEEL • COMPOSITE DIE STEEL SECTIONS • CARBON AND ALLOY STEELS • TOOL STEELS FOR SPECIAL PURPOSES • COMPOSITE HIGH SPEED STEELS • CAST-TO-SHAPE TOOL STEELS • HIGH SPEED AND ALLOY SAW STEELS
JESSOP
STEEL COMPANY · WASHINGTON, PENNSYLVANIA

Announcing new tap driver



Patent Pending

Scully-Jones non-reversing Safe-Torque Drivers may be used in any machine having a reversing spindle!

New Scully-Jones Safe-Torque Driver reduces tap breakage 400-500%

Here's the newest, most promising development in tapping from Scully-Jones! It's a completely new application of the roller-drive principle for tap drivers .... proved on the production line at Caterpillar Tractor Co. Tap breakage, scrap and production losses resulting from downtime may now be minimized. Adverse machining conditions such as hard spots, poor chip removal, inadequate cooling or lubrication, and improper sharpening of taps are brought under new, positive control. Overrunning roller drive releases instantly when torque reaches danger point ... *without* friction or wear ... *with* free-wheeling action! Here's one report from "Caterpillar" (job illustrated above): "production up 5% ... improved finish and accuracy ... 25% cost reduction ... 10-12% manpower saving ... *tap breakage reduced 500%.*" For details and delivery, contact your Scully-Jones representative or stocking distributor.

Positive release · positive reset · adjustable torque · small diameter · roller drive · free-wheeling action · no wear proved safety features · maximum speeds

BRINGS TAPPING UP TO MODERN MACHINING METHODS

Reduces tap breakage—Releases instantly and completely when torque reaches danger point. Prevents use of dull taps.

Boosts production—Builds operator's confidence in tool. Permits tapping at full speed to full depth. Operates at any speed taps can take.

Helps control quality—Releases when tap is too dull. No objectionable, overriding motion. Helps produce uniform, accurate threads.

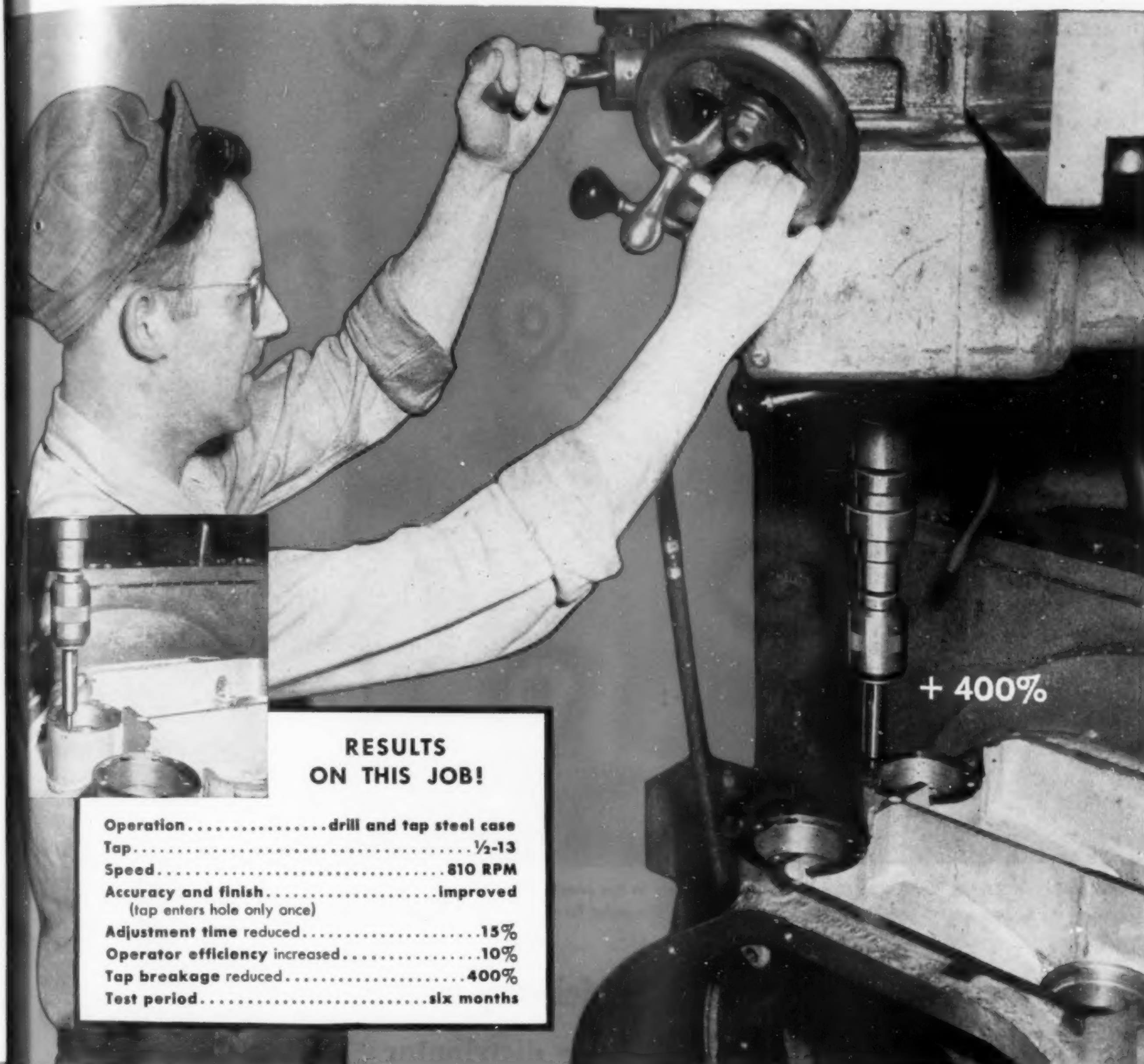
Keeps tooling costs low—Five settings provided to adjust torque for various jobs. May be used with standard Scully-Jones Quick-Change Chucks, Turret Tool Holders, Sleeves, Adjustable Adapters, and Tap Chucks.

Saves manpower and material—Dependable control minimizes scrap. Eliminates rework on piece-parts. Reduces downtime.

Makes tapping more versatile—With stop-nut on tap, number of threads may be controlled automatically. Compression spring provides a cushion for bottom-tapping in blind holes without slow-down.

Proved dependability—No overheating or change in torque, even at high overrunning speeds. Human element minimized ... torque setting not easily changed by operator.

...job-proved at "CATERPILLAR"!



RESULTS ON THIS JOB!

Operation	**drill and tap steel case**
Tap	**½-13**
Speed	**810 RPM**
Accuracy and finish (tap enters hole only once)	**improved**
Adjustment time reduced	**15%**
Operator efficiency increased	**10%**
Tap breakage reduced	**400%**
Test period	**six months**

SCULLY JONES

Precision Holding

FOR HOLDING PRECISION

Scully-Jones and Company, 1915 South Rockwell Street, Chicago 8, Illinois

NEW CATALOG!

Write for Bulletin 20-50. Gives you important features, specifications, and field-test reports on Safe-Torque Drivers.

Gentlemen: I'm interested in learning more about Scully-Jones Safe-Torque Tap Drivers . . .

☐ Please send Bulletin 20-50

☐ Have representative call

Name__________

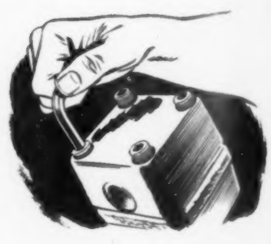
Company__________

Address__________

City__________ State__________

Four UNBRAKO Socket Head Cap Screws speed assembly in the plant, and reassembly in the field, of these flow-control valves providing 16 different inlet-outlet flow direction combinations.

The knurling on the head of the screw permits faster assembly, because it provides a slip-proof grip.



The uniform depth and size of the hex socket assure maximum torque in wrenching. The accurate diameter of the head permits countersinking.

UNBRAKOS—made of heat treated alloy steel—have fully formed threads, Class 3 fit; controlled fillet and continuous grain flow for strength. Supplied in standard sizes from # 4 to 1".

Get personalized service, faster delivery with UNBRAKO Standards—stocked by your distributor

When you use UNBRAKO socket screw products, you get the finest socket screws made, *plus* the personalized service and the faster delivery of your local distributor. And he enables you to cut your inventory, set up more space for production. For more information, write for UNBRAKO Standards—a complete listing of precision socket screw products carried by your distributor. STANDARD PRESSED STEEL Co., Jenkintown 37, Pa.

UNBRAKO® SOCKET SCREW DIVISION

SPS JENKINTOWN PENNSYLVANIA

For Unmatched Ruggedness and Capacity

Boice-Crane

15" HEAVY DUTY HELMET-HEAD

DRILL PRESSES

Handle jobs and drill holes of a size no one could attempt on other 15-inch or 14-inch drill presses, as for example this multiple hole job with an 8-spindle head attachment. Helmet Heads will stand up for many extra years under toughest service conditions.

The 15-inch Drill Presses with ⅝-inch capacity, not just the ½-inch capacity of light 15 and 14-inch machines.

Real precision at the chuck—where it counts, is guaranteed by the 50% thicker column (3/16" walls).

Up to 50% more wear resistance against accuracy destroying side thrust through a longer, and 20% larger quill (2-1/16" dia.). This pays off on deep hole drilling and routing. 4 inches or more of the quill is always anchored within the head.

Rugged steel 6-tooth, involute-shaped, splined drive sleeve. 5 speeds (25% greater range). Belt tension release for easy speed changes.

50 models, high and slow speed, bench and floor type. 1, 2, 3 and 4 spindles. A variety of work tables. A full line of tapping heads, foot feeds and accessories. Attachments for fine hollow chisel mortising. Heads and parts sold separately for special setups.

Immediate delivery by industrial supply distributors everywhere.

FOR 40 YEARS · BOICE CRANE · AMERICA'S MOST IMITATED POWER TOOLS

BOICE - CRANE COMPANY
934 Central Avenue, Toledo 6, Ohio

Please send free literature on Boice-Crane Helmet Head Drill Presses.

Name..

Firm..

Street..

City and State..

USE READER SERVICE CARD; INDICATE A-2-190-1

There's A WAY TO AVOID SPOILAGE LOSSES

When you find that your spoilage losses in tapping and reaming are running high, there's an easy way to remedy the situation if it is due, as is frequently the case, to faulty set-ups.

Just change over from ordinary tool holders to Ziegler Tool Holders. With the Ziegler all you have to do is to come within 1/32" of center on the radius (or 1/16" on the diameter) and the holder automatically compensates for the difference.

In the rejects it eliminates, the Ziegler Holder pays for itself many times over in a remarkably short time. Get one and see what a difference it will make in the precision of the work performed.

W. M. ZIEGLER TOOL COMPANY
13574 AUBURN DETROIT 23, MICH.

WRITE FOR CATALOG

Ziegler ROLLER DRIVE FLOATING HOLDER for Taps and Reamers...

USE READER SERVICE CARD; INDICATE A-2-190-2

TAPER PIPE THREADS tapped on a drill press with "Auto-tap"

TRADE MARK

LEAD SCREW TAPPING ATTACHMENT

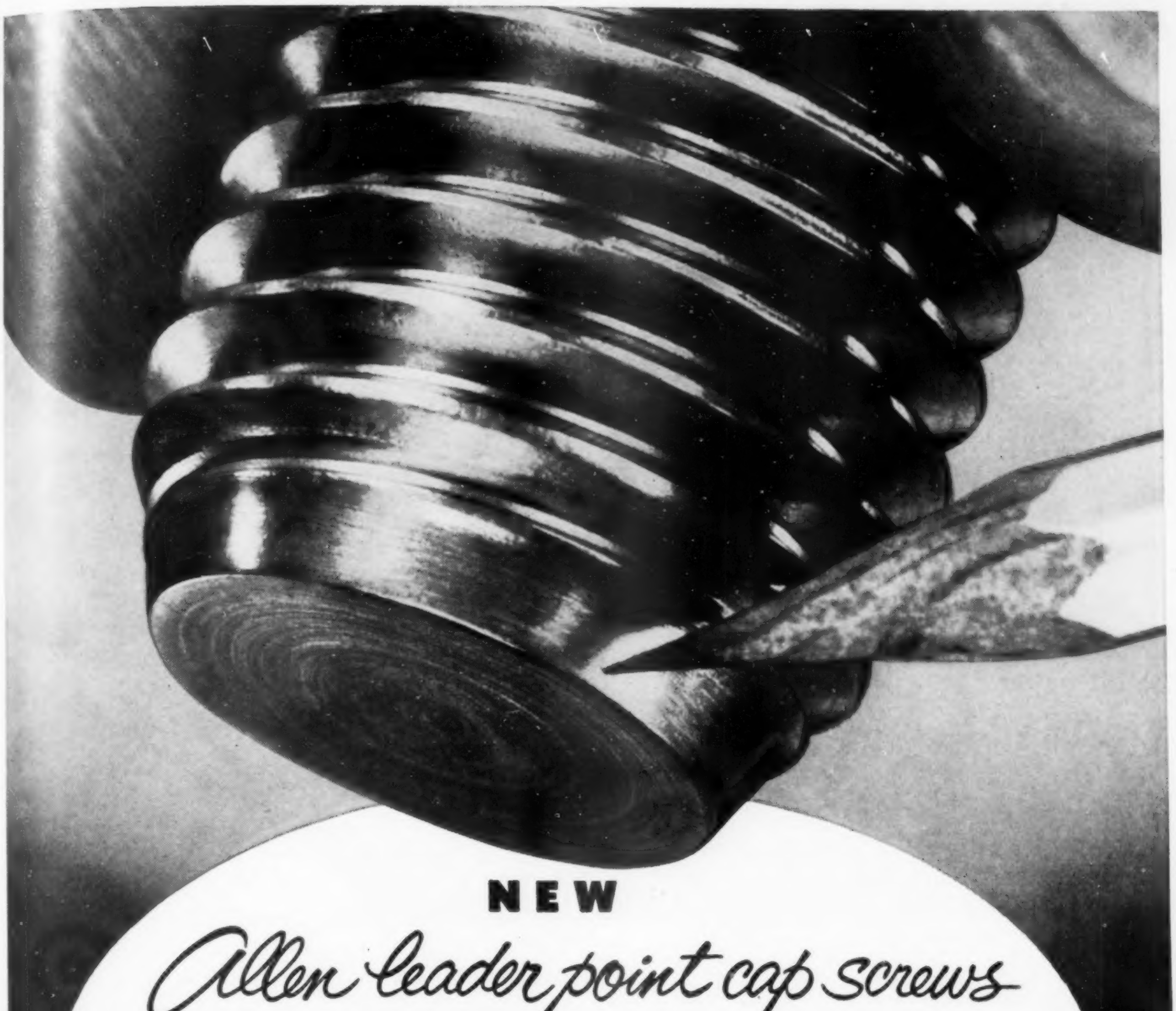
Quicker. Better. Less scrap. No skilled help needed.

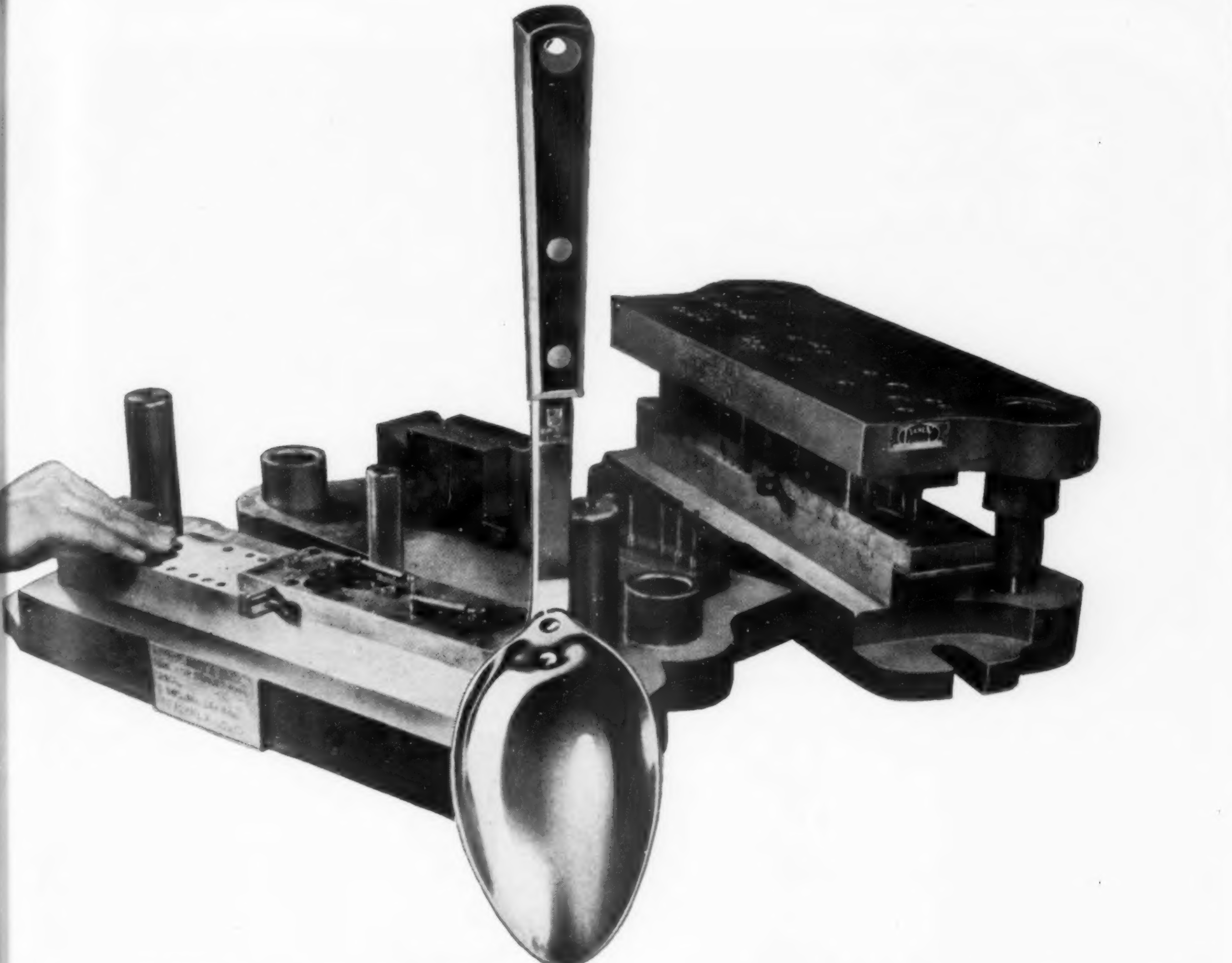
Send for Bulletin

Automatic Methods INC.
PRECISION PARTS FOR AIRCRAFT

944B West Grand St., Elizabeth, N. J.

USE READER SERVICE CARD; INDICATE A-2-190-3

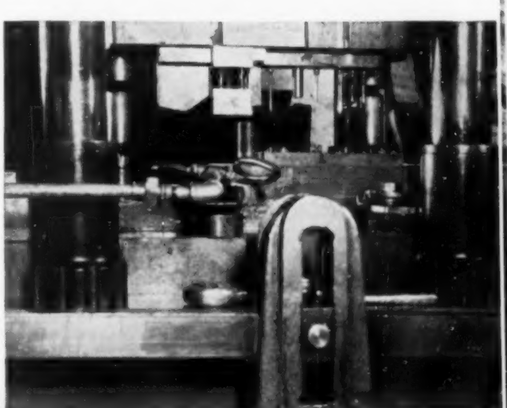

NEW
Allen leader point cap screws
Dropping, knocking against metal surfaces and faulty line-up are major causes of damaged threads. Allen's new unthreaded leader point substantially reduces the causes of screw thread injury, or damage to threaded holes. Grip Heads, precision fit sockets that adhere to the key, *plus* the new leader points, make Allens the world's easiest starting cap screws, particularly in inaccessible spots. Sold *only* thru leading Industrial Distributors.
ALLEN HEAD
ALLEN
MANUFACTURING COMPANY
Hartford 2, Connecticut U.S.A.



Ekco DEPENDS ON DANLY to save tooling time!

This popular basting spoon is one of thousands of famous household items made by Ekco Products Company in dies mounted in Danly Die Sets. Ekco depends on Danly Die Sets to save costly tooling time and help maintain uninterrupted production schedules in this highly competitive industry, because Danly Die Sets provide the finest *precision* starting point for diemaking. They are available on short notice from a completely stocked Danly assembly plant nearby.

It's a point worth remembering . . . when the job calls for *precision* performance, *depend on Danly Die Sets!* There's a Danly Branch near you . . . stocked for immediate delivery.



Call Your Local Danly Branch Today!

***CHICAGO** 50—2100 S. Laramie Ave.
***CLEVELAND** 14—1550 East 33rd St.
***DAYTON** 7—3196 Delphos Ave.
***DETROIT** 16—1549 Temple Ave.
***GRAND RAPIDS** —113 Michigan St., N.W.
INDIANAPOLIS 4—5 West 10th St.
***LONG ISLAND CITY** —47-28 37th St.
***LOS ANGELES** 54—Ducommun Metals & Supply Co., 4890 South Alameda
MILWAUKEE 2—111 E. Wisconsin Ave.
***PHILADELPHIA** 40—511 W. Courtland St.
***ROCHESTER** 6—33 Rutter St.

**Indicates complete stock*

DANLY

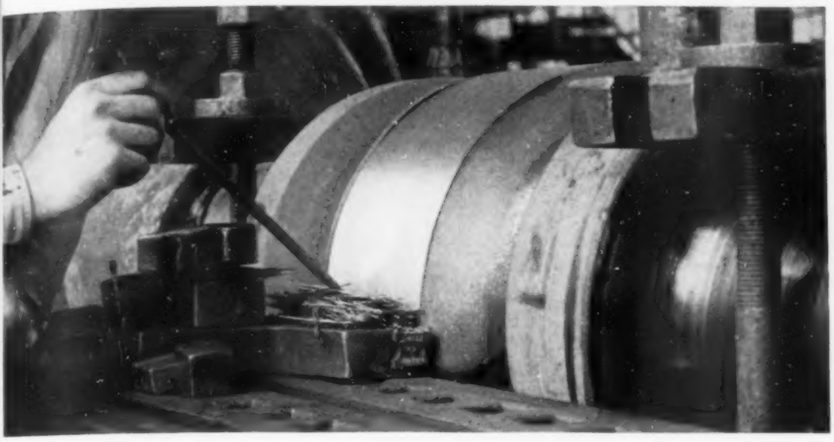
DIE SETS . . . STANDARD OR SPECIAL
DIEMAKERS SUPPLIES

DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue
Chicago 50, Illinois

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

...the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation



Red Sabre Bit Does Double Duty

Roll-dressing in a mill where steel bars are rolled had long been considered an operation requiring two types of tool steels. For the roughing cuts they used tool bits made of high-speed steel. And for the finishing cuts, they turned to water-hardening steels.

But someone got to thinking, Why not try Red Sabre? Then maybe one tool steel could be used for both jobs.

So Red Sabre was put to work, and is giving an excellent account of itself on alloy-iron and cast-steel rolls having a hardness of 48 to 60 Shore.

The roughing operation is shown above. The hardened-and-ground block-cutter tool, $1\frac{1}{4}$ in. high, $1\frac{1}{2}$ in. wide, and $8\frac{1}{4}$ in. long, and with four cutting edges, is making a cut approximately .006 in. deep. The finishing cut, less than .001 in. deep, is made without changing the tool set-up. Both operations are performed at a surface speed of 40 in. to 60 in. per minute, depending on the diameter of the roll.

Red Sabre is our super-high-speed steel, containing approximately 1.50 carbon, 12.00 tungsten, 5.00 vanadium and 5.00 cobalt. It is unusually resistant to abrasion and wear, and has higher red-hardness than most high-speed steels.

Red Sabre tool bits, hardened to a minimum of Rockwell C-65 and accurately ground, are stocked in all standard sizes. If you'd like to try them out in your shop, put it up to your tool steel distributor. Or if you prefer, order direct from us at Bethlehem, Pa.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

This Is Why We Anneal Most Tool Steel Bars

In the majority of cases, bars of Bethlehem tool steel are furnished in the annealed condition, both to users and distributors. There are two important reasons why this is so:

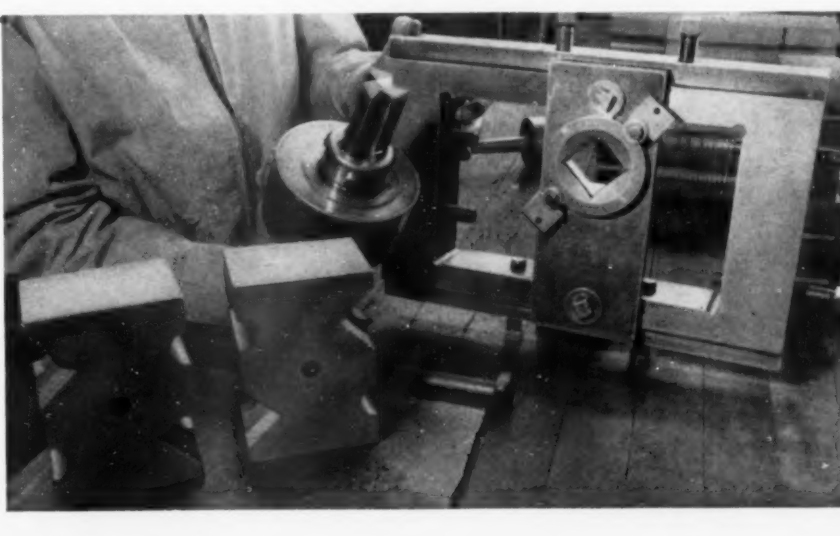
1. The process of annealing makes it possible to remove the stresses occurring in the as-rolled or as-forged bars. If such stresses were not removed, they could very well lead to cracking, resulting in delay and increased shop costs.

2. With many types of tool steels, it is necessary to obtain the lowest degree of hardness in order to secure the best machinability. But for other grades of tool steels, low hardness is undesirable. For this reason, annealing is carefully controlled to produce the proper degree of hardness for the grade involved.

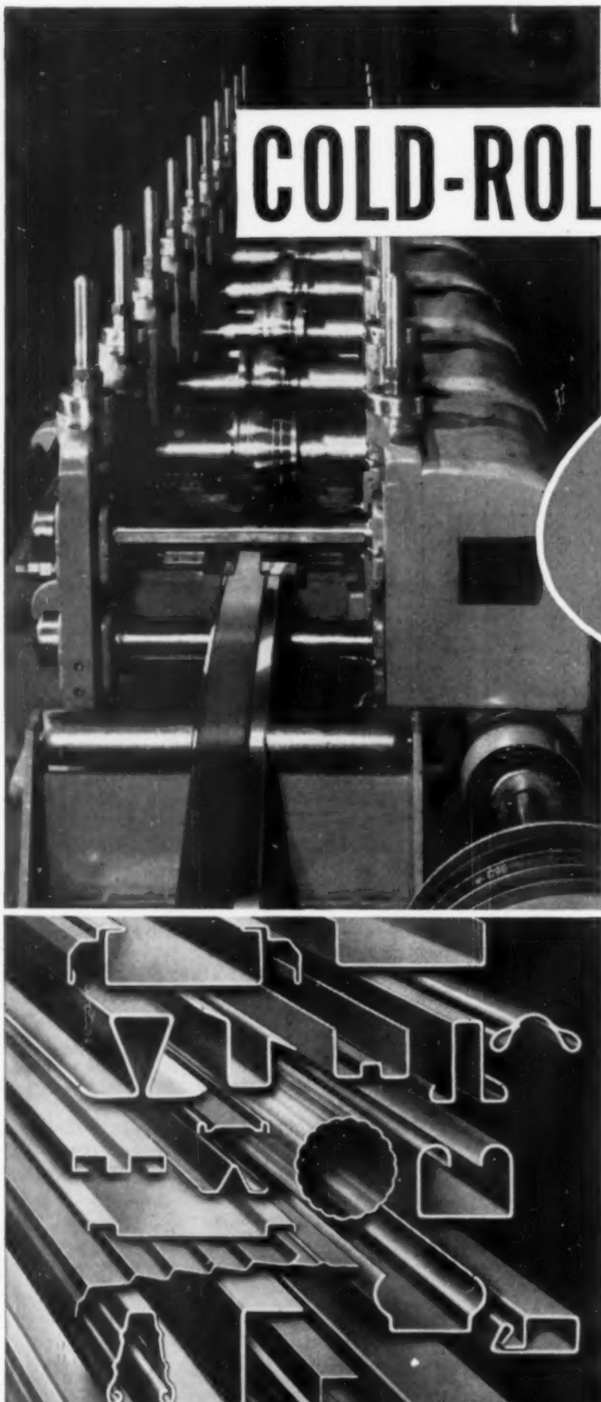
Here's another point to remember—excessive scaling and decarburization must be avoided during annealing. We find the bell-type, controlled-atmosphere furnaces used in our tool-steel mill excellent for this purpose. In fact, with these furnaces we obtain results which are far superior to what is possible when other types of annealing equipment are used.

MACHINE BOLT FORMING DIES MADE OF CR-MO-W

Making forming dies which are capable of turning out thousands of square-head machine bolts each day is a task calling for a top-notch grade of tool steel. That's why Bethlehem Pacific, the largest maker of bolts on the West Coast, selected Cr-Mo-W (Chrome-Moly-Tungsten) tool steel for making dies used in bolt manufacture. Like many other tool-steel users, they find Cr-Mo-W ideal for jobs involving shock or drastic temperature changes, as well as for applications where heat-checking is a problem. Cr-Mo-W, our general-purpose type of hot-work tool steel, is air-hardening, and has good red-hardness and good machinability.



COLD-ROLL FORMING...



a CHALLENGE and a PROMISE

Cold Roll Forming holds a perpetual challenge to your skill and ingenuity in devising new ways to step up production and reduce cost. Infinite possibilities are suggested by thousands of existing applications in the high-production metal working industries.

New applications are constantly being discovered. Total production of Yoder cold roll forming machines now runs into billions of feet annually.

A Yoder roll forming machine can be arranged for doing other operations, such as notching, embossing, perforating, curving, coiling, welding, etc., at little or no extra labor cost. Yoder engineers are at your service in designing such multi-purpose production lines.

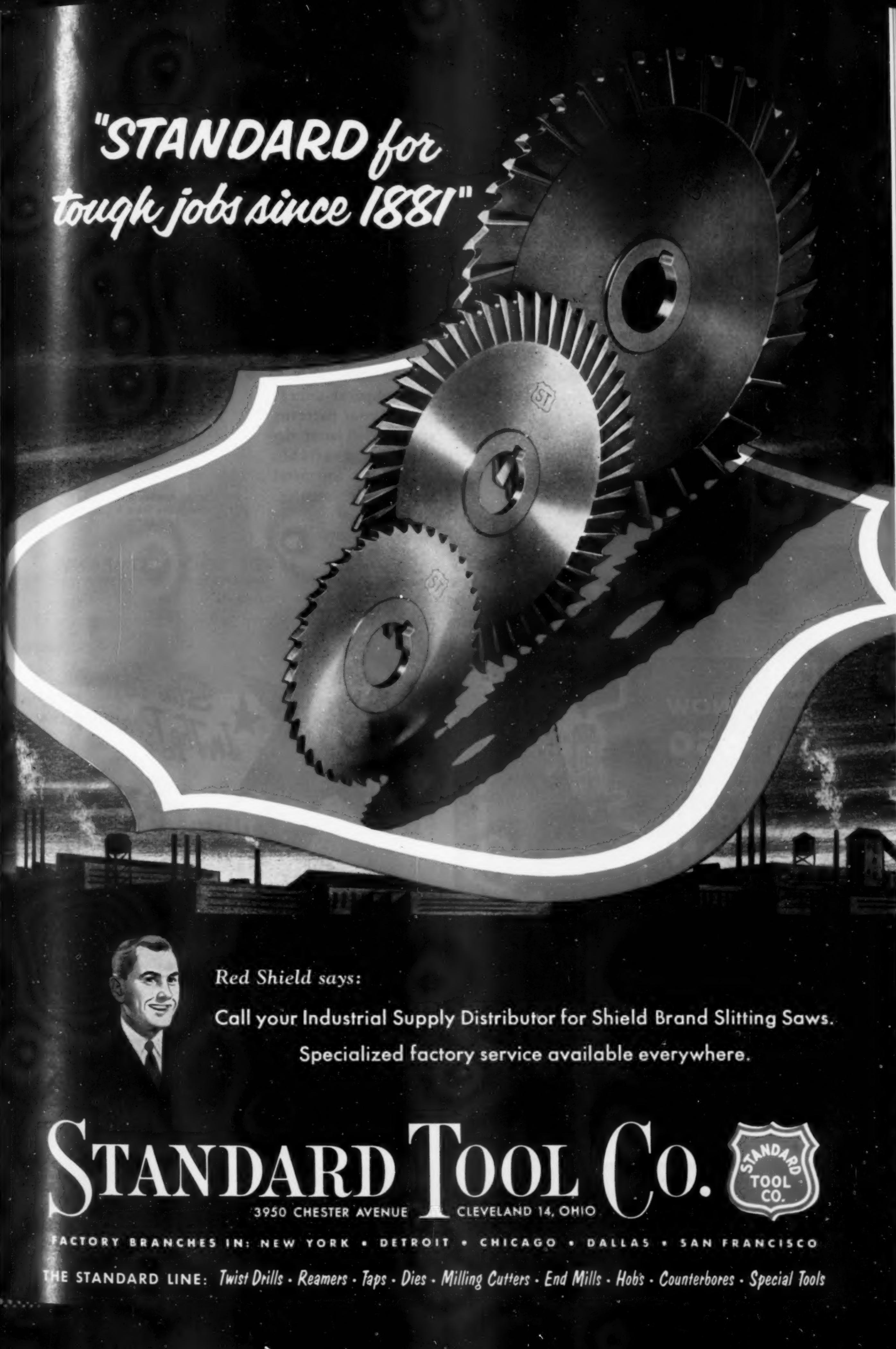
The Yoder Book on Cold Roll Forming discusses its varied functions and advantages, with scores of photos illustrating end uses of roll formed products. Ask for it.

THE YODER COMPANY
5525 Walworth Ave. • Cleveland 2, Ohio

Complete Production Lines

- ★ **COLD-ROLL-FORMING and auxiliary machinery**
- ★ **GANG SLITTING LINES for Coils and Sheets**
- ★ **PIPE and TUBE MILLS–cold forming and welding**

ENGINEERING YODER MANUFACTURING

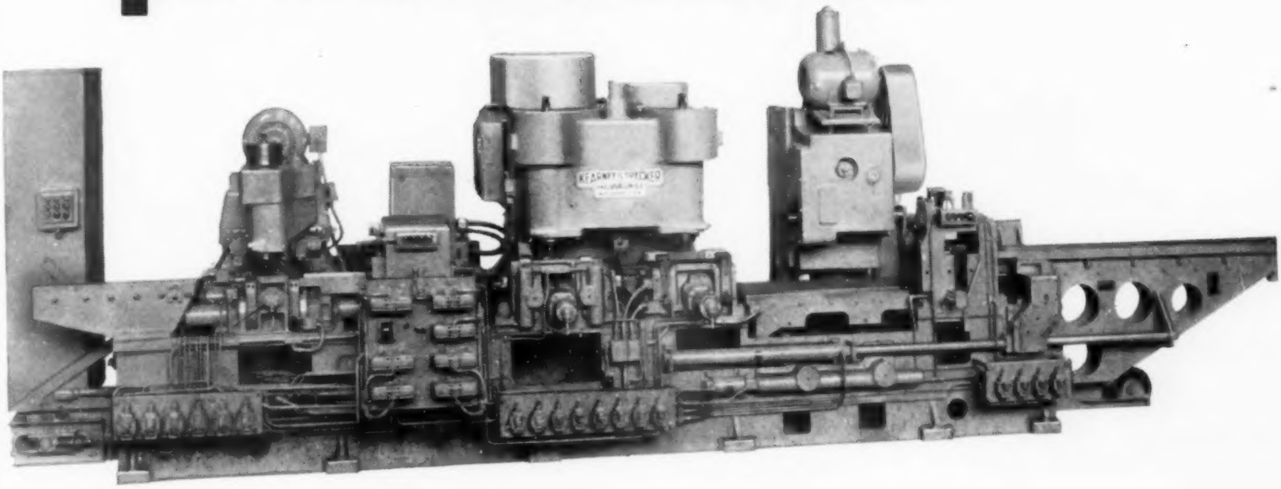

"STANDARD for tough jobs since 1881"
ST
Red Shield says:
Call your Industrial Supply Distributor for Shield Brand Slitting Saws.
Specialized factory service available everywhere.
STANDARD TOOL CO.
STANDARD TOOL CO.
3950 CHESTER AVENUE CLEVELAND 14, OHIO
FACTORY BRANCHES IN: NEW YORK • DETROIT • CHICAGO • DALLAS • SAN FRANCISCO
THE STANDARD LINE: Twist Drills · Reamers · Taps · Dies · Milling Cutters · End Mills · Hobs · Counterbores · Special Tools

Talk about production...

KEARNEY & TRECKER
MILWAUKEE
MACHINE TOOLS

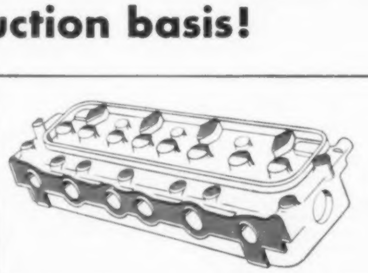
Special Machinery Division

Builders of Precision and Production Machine Tools since 1898



For the customer . . .

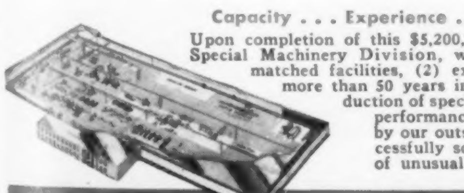
it put a one-at-a-time rough and finish milling job on a production basis!



Color indicates machined surfaces

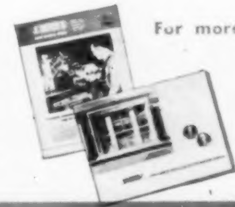
THIS special seven-station traveling head transfer type milling machine solved an automotive manufacturer's problem that involved milling cylinder heads. Formerly, rough and finish milling of a six-cylinder head required six distinct machining operations and seven separate handlings. Now, by combining all the machining operations and eliminating handling . . . the special machine produces 62 finished pieces per hour.

TRAVELING HEADS . . . three heads — one with one spindle and two with three spindles. Full quill adjustment on all spindles. Speeds are fixed. Heads travel hydraulically on hardened and ground ways.



Capacity . . . Experience . . . Performance

Upon completion of this $5,200,000 expansion of our Special Machinery Division, we offer you (1) unmatched facilities, (2) experience based upon more than 50 years in the design and production of special machinery, and (3) performance, best recommended by our outstanding record of successfully solving many hundreds of unusual machining problems.



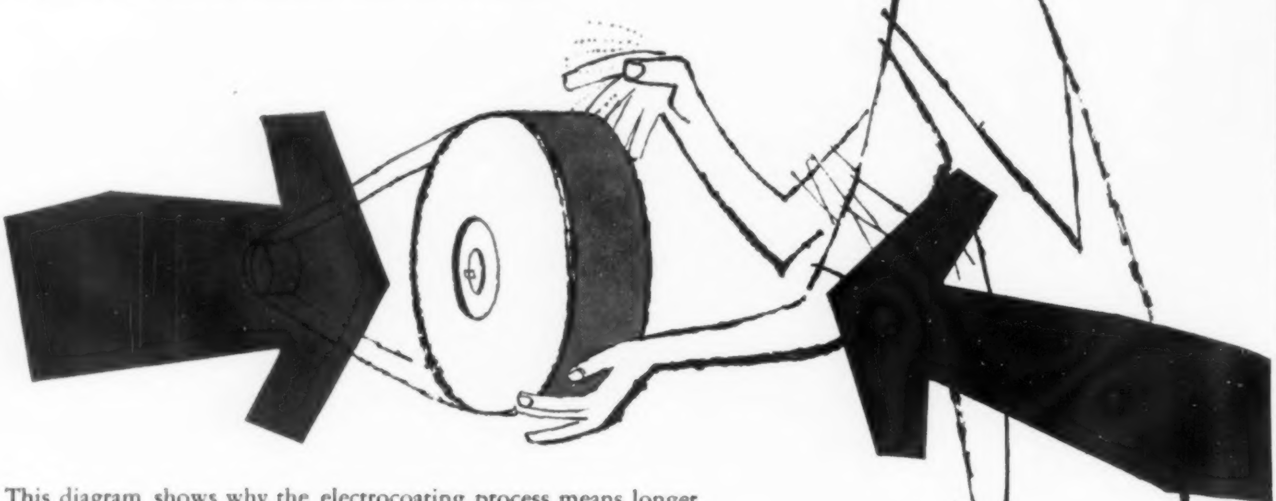
For more details on this machine . . . ask for *Data Sheet No. 1003*. Free booklet, "Doorway to a proven method for solution of big and small metalworking problems" is also yours for the asking. *Write today to* SPECIAL MACHINERY DIVISION, KEARNEY & TRECKER CORP., 6784 West National Ave., Milwaukee 14, Wisconsin.

KEARNEY & TRECKER CORP. · *Special Machinery Division*
MILWAUKEE 14, WIS., U. S. A.

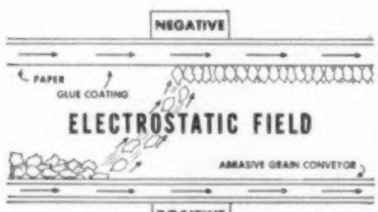
Don't change that belt!

It's Armour's—longer lasting because it's precision-made!

You save money when you use Armour's abrasives because they're scientifically made to last longer. The tough grains of superior abrasives are electrocoated firmly and uniformly into a powerful, long-lasting adhesive. And all the sharp points grind and polish longer because they're precision-placed for equal wear!

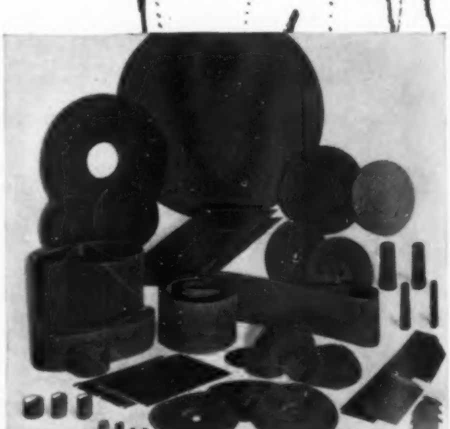


This diagram shows why the electrocoating process means longer life for all of Armour's precision abrasives. Notice how the Armour grains are attracted to the upper electrode, fixing themselves firmly at right angles to the backing. This gives the abrasive sharper, longer cutting action. It means more production for you at lower cost.



Belts are just one item in Armour's *complete line* of precision abrasives. Alundum, Garalun, Garnet and Crystolon in rolls of paper, cloth and combination, sheets, belts, discs, and other specialized forms are all available to help you solve your abrasive problems. Call your industrial distributor today for Armour abrasives!

The booklet offered here will save you money in storing coated abrasives. Send the coupon for your free copy now.



Armour Coated Abrasives
Armour and Company • North Benton Road, Alliance, Ohio

Please send me the free booklet, "How To Store Coated Abrasives"

Name .... Title ....

Firm ....

Address ....

City .... Zone .... State ....

T

ARMOUR *Coated Abrasives*

Armour and Company • Alliance, Ohio

JIG GRINDING ACCURACY *guaranteed**

INFINITE CONTROLLED SPEEDS 30,000 TO 65,000 R. P. M.

Easily connect jig grinder to jig borer or mill

Then you can finish grind in hardened steel to "tenths" . . . jig grind dowel holes square with a ground base . . . move location of holes in hardened steel blocks . . . jig grind interchangeable holes in hardened sections . . . grind small holes with diamond impregnated mandrels . . . grind contours and relief with tungsten carbide burrs . . . grind radii in die sections . . . eliminate jig bushings in tools where close spacing is essential.

Other infinitely controlled air driven spindle applications

Place spindle on most any machine. Use it for finishing contours on hardened steel working surfaces . . . burring or milling die castings . . . routing wood contours . . . carbide milling or finishing slots . . . finishing holes in hardened steel to "tenths" . . . grinding with diamond wheels, carbide burrs, or diamond impregnated mandrels.

Advantages—10 micro finishes using carbide mills . . . 6 micro finishes using mounted points, operates at any angle . . . air driven, air cooled, overheating prevented . . . speed controlled at optimum point . . . 3⅗₁₆" long motor uses little working space . . . By controlling speed at any point you abolish need for many constant speed spindles.

For immediate quotation please state machine tool application. Get this manual of photos showing operations Vulcanaire performs.

*Dependably accurate to "tenths"

Vulcanaire

It's built by toolmakers for toolmakers

VULCAN TOOL CO., 7300 LORAIN ST., DAYTON 10, OHIO

USE READER SERVICE CARD; INDICATE A-2-206-1

More and More Industries are Cutting Costs and Speeding Up Production *with...*

ROUSSELLE Presses!

It took some concentrated planning, stressing ruggedness and simplicity, along with accurate machining and "close-tolerance" assembly to bring out these fast, rigid, high output units —THAT COST SO LITTLE—DO SO MUCH —REQUIRE SO LITTLE MAINTENANCE.

In addition to metal forming, bending, shearing, notching, and piercing, they are also adaptable to cutting and punching paper, forming and cutting fibre, plastics, etc.

Often considerable savings are possible if you let our engineering staff assist you. There is no obligation. Simply explain the problem and send sample or drawing of work.

Rousselle Presses are Sold Exclusively through Leading Machinery Dealers and are manufactured by

SERVICE MACHINE CO.

7627-33 S. Ashland Ave. • Chicago 20, Illinois

USE READER SERVICE CARD; INDICATE A-2-205-2

Made to your Order...

FULLER

Cutting Tools

SPECIAL, HIGH-PRECISION HIGH-SPEED STEEL & CARBIDE TIPPED

FULLER TOOL CO.

4000 WEST ELEVEN MILE RD.

BERKLEY, MICH. LINCOLN 2-5600

USE READER SERVICE CARD; INDICATE A-2-206-3

NOW—
A Diaphragm Chuck

that really holds for heavy cutting!

A simple, ball and taper mechanism multiplies the force of the air used for flexing the diaphragm of this chuck to permit use of a stiffer diaphragm than has ever before been possible. When air is released, the jaws clamp down with a grip many times that of ordinary diaphragm chucks. Plants already using the "Super-Grip" find it the answer to their problem of holding work for heavy cutting. Offers accurate repeat and many other superior features. Write for our catalog.

SCC

Sheffer Collet Company

TRAVERSE CITY, MICHIGAN

out many parts per hour at low cost per part

You can combine your drilling, c'boring, reaming, tapping, light milling, recessing, spotfacing or threading operations — and reduce your costs.

Your part can be of any metal or material that can be machined economically. It must be of a size and weight which can be machined within the limits of 5 HP units and be handled efficiently by your operator. You must want a lot of parts per man-hour, because you'll get high production.

You'll get uniform accuracy. Your scrap loss will be reduced to a minimum. You'll save floor space. You'll eliminate re-handling. In fact, you'll be very happy about the whole thing!

Now, a word about the costs quoted in this advertisement. These costs amortize the entire Kingsbury investment over 6000 hours. This is a fraction of its useful life! They include the cost of the man and machine, but no power or overhead.

They assume unit cost of the man to be:

$$\frac{\textbf{average U. S. hourly wage}}{\textbf{hourly gross X 80\% efficiency}}$$

They assume unit cost of machine to be:

$$\frac{\textbf{price of tooled machine}}{\textbf{output in 6000 hrs. at 80\% efficiency}}$$

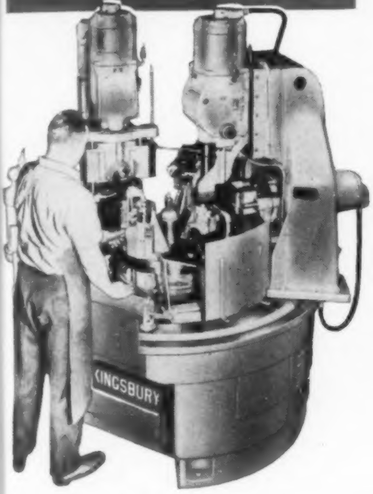
Each Kingsbury machine is custom-built to do a specific group of jobs — and is given a trial run for your approval of the machined part before delivery. Are you really interested? If so, we'd like to see you.

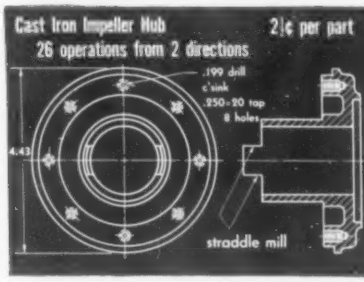
Kingsbury Machine Tool Corp.
103 Laurel St., Keene, N. H.

← Steel Transmission Sleeve

350 parts per hour gross—1-4/10¢ each

Note plan view drawing — it shows the angles. Four work fixtures are located on a 20-in. index turret. All work is performed at three stations. Two horizontal and two vertical drilling units are mounted on the 60-in. base. One vertical drilling unit has a milling attachment with side adjustment to compensate for cutter wear. Work fixtures are unclamped automatically at the unloading station.



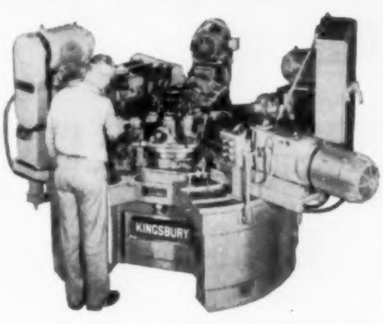


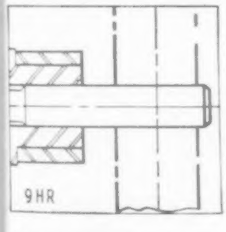
Cast Iron Impeller Hub →

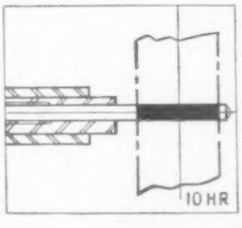
204 parts per hour—2½¢ each

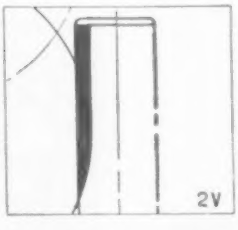
In this Kingsbury the units are located on the 80-inch base, and the work fixtures on a 26-in. turret. There are 8 stations.

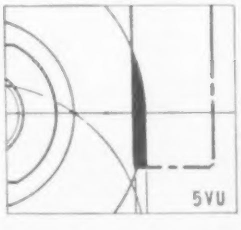
The machine performs 26 operations. Eight holes are drilled, c'sunk and tapped. But the milling operation is the most interesting. A milling unit is attached to a drilling unit equipped with a 7-in. stroke attachment. Cutters feed from right to left through the work, straddling the material.











12 parts receives 17 operations from 4 directions

Horizontal Holes: Drills are located accurately by sliding tool guide bushing carriers piloted to each work fixture.

Unit 4H (right) has a 2-spindle auxiliary head — drills two .156 holes thru into axial hole on center line of keyway. *Unit 8H* (right) operates 2 spindles — drills .156 and .359 through shaft. *Unit 9H* (right) reams the .359 hole to .378/.377 diameter. *Unit 10H* (right) .125 drills through.

Keyways: At top of shaft, .156 wide keyway is rough- and finish-milled by units at 2V and 3V. At bottom of shaft keyway is milled .065 wide by *Unit 5U* (under), as shown in photograph at right. All milling units can be adjusted to maintain accuracy.

* * *

At Station 12 (where operator loads and unloads the machine) an air-operated identification stamp works on top end of the shaft just prior to the unclamping of the work-holding fixture.

 FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-209

There's a reason 76%*

of all popularly-priced Tool and Cutter Grinders sold in 1952 were *"Knock-Outs"*

MODEL B860

Will do anything that machines costing 2 or 3 times more will do . . . yes and in less time.

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*Sales Statistics Furnished on Request

K. O. LEE CO.
ABERDEEN, S. D.

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The OLDEST Die Set Manufacturer
. . . The NEWEST Die Set Design

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HARD . . .
tough . . .
concentric . . .

Precision-made of both Carbon Vanadium and high carbon, high chrome steels. Available in a wide range of stock sizes from 1/32" to 1" point diameters in increments of 1/64" for immediate delivery. Decimal sizes to order for delivery within 48 hrs.

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Ring Type or Press Fit

Hole tapered to eliminate slug jamming. Sizes in stock to match punch sizes.

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They are terrifically popular because the six staggered cutting edges are scientifically designed to give a shearing cut and thus eliminate all chatter. Made in 12 sizes in all degrees; also supplied as sets in strong Kit-cases.

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Inasmuch as we manufacture cams and tools for the trade we obviously do so on a production basis. As a result we offer:

1. Superior type tools . . . at low cost.
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Tool making with us is a routine matter. Special equipment . . . skilled hands . . . plus know how, enables us to fill orders in a minimum of time.

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ENGINEERS TO AN INDUSTRY

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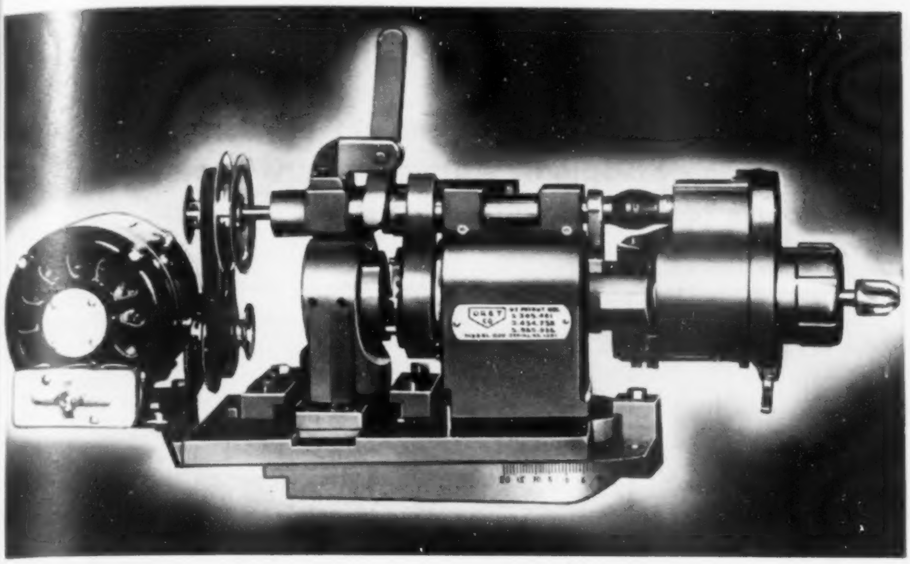
Precision CIRCULARITY GRINDING ATTACHMENT



Simple, speedy set-ups on this accurate attachment permit fast and easy grinding of form relief, radial relief, form and radial relief together, tapered cylindrical and straight cylindrical. Cutting tool to be produced or reworked is held in collet or between dead centers and revolves on its own axial center. Where full length of spiral cutting tools is to be ground for both form and radial relief, the Circularity Grinding Attachment travel is similar to an O.D. grinder, which insures fine finish, back taper and accurate size.

The Detroit Reamer & Tool Company Model 500 Circularity Grinding Attachment shown above is faster, easier to handle, has positive control, greater adaptability, rugged construction, and is engineered and precision built to provide the finest in precision work. Therefore, it will be of invaluable assistance to anyone whose tooling standards must meet modern production requirements.

You Can Grind Tools Like These

on a **DETROIT REAMER CIRCULARITY GRINDING ATTACHMENT**

Special Cutting Tools of DEPENDABLE QUALITY

The Detroit Reamer & Tool Co. Plant is equipped with the finest in modern machinery and inspection facilities to provide you with the ultimate in precision tools. Our Engineering and production personnel with 35 years of empirical knowledge behind them are completely qualified to expertly handle your tool needs. For dependable cutting tools—specify Detroit Reamer & Tool Co.

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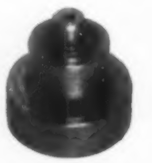
DR & T COMPANY

How Warner & Swasey Automatics cut costs for Thor Power Tool Company

Take a look at some of the typical time and cost savings delivered by Warner & Swasey 5-Spindle Automatic Bar Machines at Thor Power Tool Co., Aurora, Illinois...



REDUCTION GEAR BLANKS

Savings pay for several new machines!

Large variety required—in lot sizes of 150-1500 pieces. Material: 8460 Steel.

Previous method: 2 single-spindle automatics, running continuously.

NOW—one Warner & Swasey 5-Spindle Automatic does complete machining in equivalent of 4 days a week.

DRIVE SHAFT IMPACT SPINDLES

Accuracy and rigidity deliver 4 to 1 savings!

Material: Super tough rivet set alloy, especially made for Thor.

Previous method: Roughed on single-spindle automatic, straddled to length on turret lathe—both machines running at half speed.

NOW—finished for grinding in single operation on Warner & Swasey 5-Spindle Automatic running at full speed.

THIN WALLED PROTECTION NUT

Combines operations at high removal rate!

Previous method: Three operations—rough turned, relief cut made in second operation, Class 3 threads hobbed in third. Cost of last step alone ran 20¢ per part.

NOW—finished in one operation in 132 seconds on Warner & Swasey 5-Spindle Automatic.

REDUCER BUSHING

Cuts Class 4 threads in same operation—costs reduced 8.5 to 1!

Previous method: Threads milled, following rough forming on single-spindle automatic.

NOW—Complete machining finished on Warner & Swasey 5-Spindle Automatic in one operation in 27 seconds!

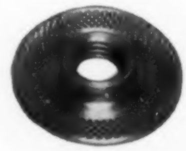
LOCK COLLAR

Slashes machining time on longer runs!

Quantities: 20,000—30,000 pieces.

Previous method: Run on conventional multi-spindle automatics in 75 seconds.

NOW—on Warner & Swasey 5-Spindle Automatics parts made in 27 seconds!



SANDING PAD NUT

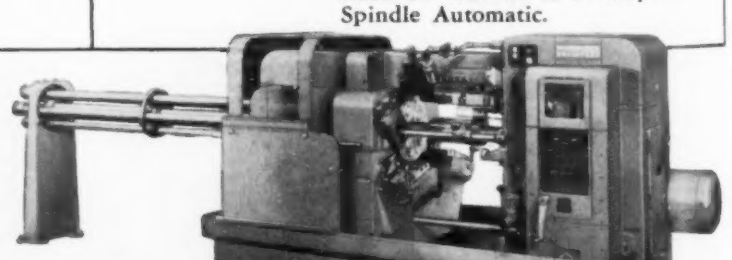
One machine does work spread over 3 departments!

Problem: To thread part at perfect 90° angle to outside face, and hold concentricity.

Previous method: Part machined in 3 different departments. Difficulty was experienced in holding piece in fixture for knurling.

NOW—Thread tapped into bar stock and balance of cuts made, including knurling, in one operation on Warner & Swasey 5-Spindle Automatic.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880



WARNER & SWASEY
5-SPINDLE AUTOMATIC BAR MACHINE

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS WITH WARNER & SWASEY MACHINE TOOLS, TEXTILE MACHINERY, CONSTRUCTION MACHINERY

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-212

The cobra strikes its prey with unerring precision.

Accurate . . .

As true as the deadly thrust of the cobra — Bath Taps bite into metal with the precision that comes only from proper pitch diameter, lead and angle.

What does Bath Tap accuracy mean to you?

It means dependability on long runs . . . performance that is beyond the standard required by inspection . . . freedom from costly production delays.

Accuracy is a built-in Bath Tap feature. It begins with engineering design and is maintained by quality control throughout all the steps of manufacture.

In this age of mass production, down-time is costly. Un-interrupted assembly line operation requires consistently accurate measurement—an inherent quality of stock and custom built Bath Taps.

Let us put you in touch with a Bath representative or, write us direct for technical advice on your tapping problems.

Bath engineers check every detail, to see that all Bath Taps are conditioned to do the best threading job for your requirements.

Insist on BATH TAPS for BETTER THREADS

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BRISTOL'S HEX SOCKET CAP SCREWS

help you get better design...faster production...easier maintenance!

Bristol Hex Socket Cap Screws give a new kind of socket screw performance. Used in products ranging from electric razors to massive machine tools, these modern fasteners have proved themselves with design, production and maintenance men everywhere. Here's why:

Made of special alloy steel, and specially treated to develop the proper hardness and strength, Bristol Hex Socket Cap Screws will give long service under the most severe conditions.

Bristol's Hex Socket Cap Screws set faster and easier, speeding up assembly on the production line. And they do away with protruding screw heads, giving smooth, flush surfaces for safety and streamlined appearance.

There's no delivery problem with Bristol's Hex Socket Cap Screws, either. Adequate stock is on hand to fill all orders without delay. In sizes ranging from No. 0 wire to 1 inch, all of Bristol's screws are precision-made to conform to Class 3 fit.

Write today for your free copy of Bristol's 40-page catalog on hex socket screws.

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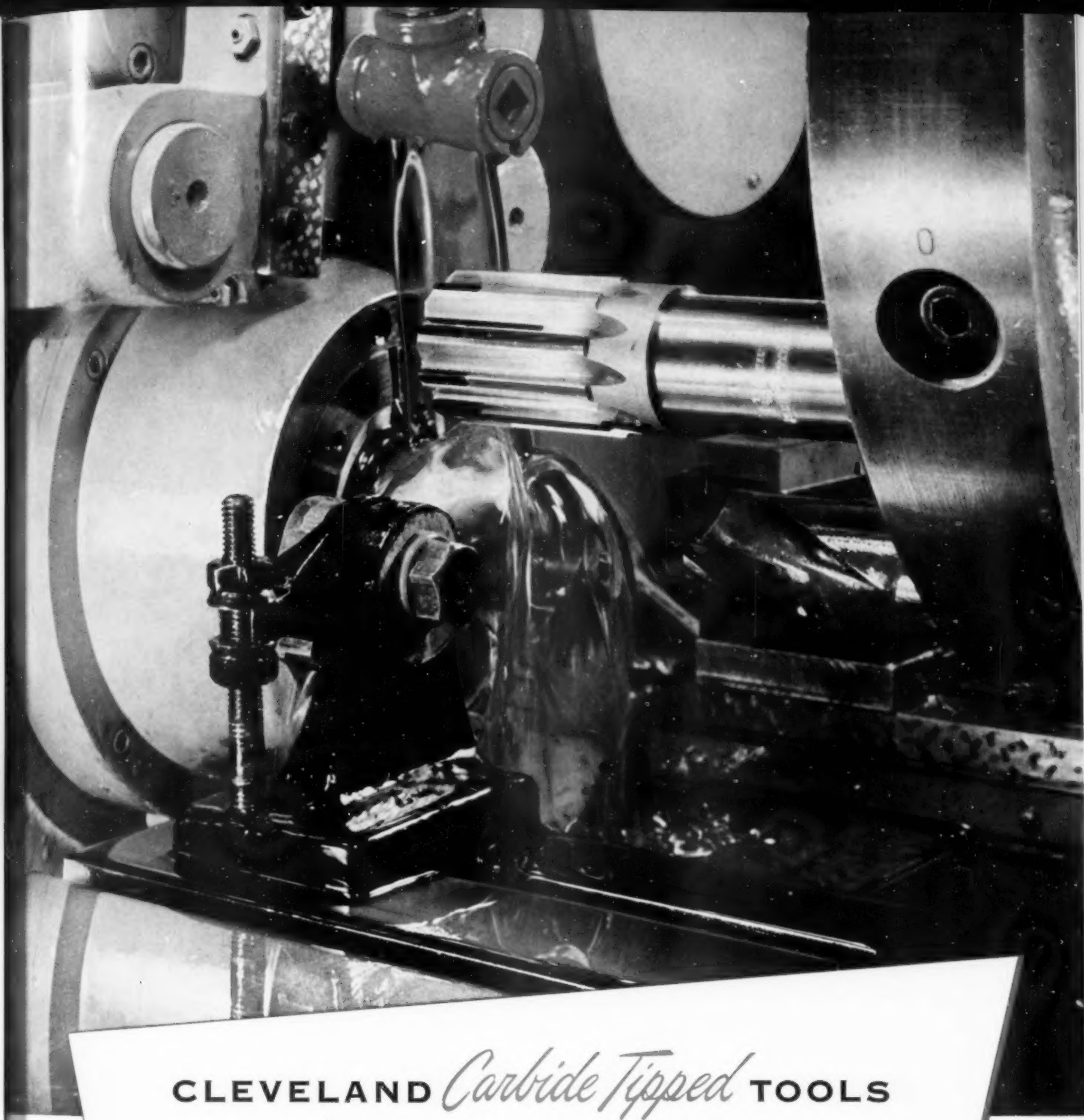
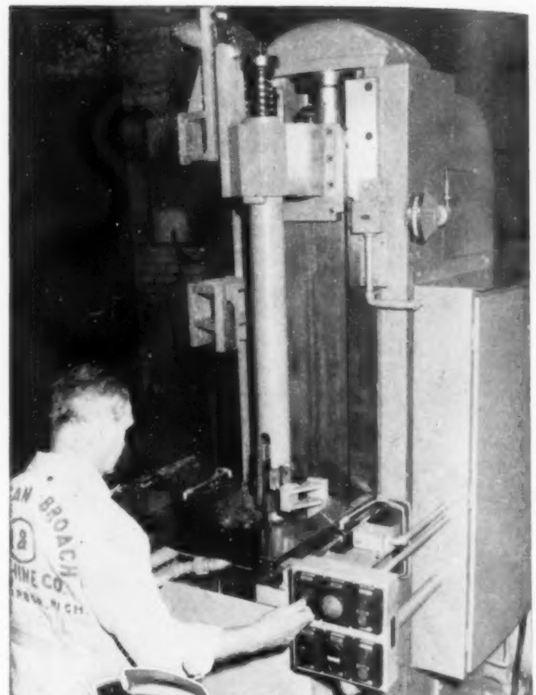
BRISTOL'S SOCKET SCREWS

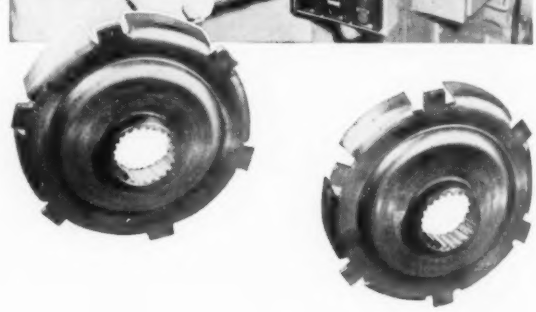
THE BRISTOL COMPANY, Socket Screw Division, Waterbury 20, Conn.



Fixed broaches + automatic cycle } = HIGH PRODUCTION

by broaching the *American* way





PROBLEM To broach six external lugs on a stamped transmission clutch flange part in one pass.
(The previous broaching set-up consisted of three fixed broaches on the machine slide, a receding table and an indexing type fixture. Three lugs were broached in one pass, the table receded, the fixture indexed 180° and the opposite three lugs broached. This did not meet production requirements nor accuracy as the receding table and index fixture allowed too great an accumulation of error.)

SOLUTION A special American 10 ton, 42 inch stroke vertical broaching machine arranged to push the part past six stationary roughing broaches in one pot which nibble and adjustable finishing broaches in the second pot which shave the part. A 3 to 4 times hourly production increase with the part held within the tolerance was the results of this ENGINEERED PRODUCTION broaching operation by American.

OPERATING CYCLE: The operator first loads a part and starts the automatic machine cycle with dual push buttons. The transfer slide moves forward to broaching position and automatically starts the main ram down. Fastened to the ram is a push bar which locates the part and pushes it through the stationary broaches. The part is automatically discharged at the end of the stroke. The automatic transfer slide returns to loading position allowing the operator to reload while the push bar is returning up.

American can give you this Greater Production Economy

This is only one example of how broaching the American-way solved this manufacturer's problems. Because American manufactures a complete line of broaches, broaching machines and fixtures, they can help *you* engineer your job *completely* to obtain the greatest production economy. Start American working for you by sending a part print or sample and your hourly requirements.

Write for Circular 300 showing American's complete line of hydraulic surface broaching machines.

AMERICAN

***American* BROACH & MACHINE CO.**

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

SUNDSTRAND

Graph-Mo® steel die makes this "impossible" draw without galling or scoring

MANUFACTURERS Service Company in Cleveland was faced with a tough problem of making a die for a dryer fan housing 3⅞" deep. The scroll shape made it an all but impossible draw for ordinary die steels—they'd pick up and gall. Looking for an answer, they tried Graph-Mo®—one of four graphitic tool steels developed by the Timken Company. Result: good clean parts, no scuffing, no galling, no scoring.

Graph-Mo tool steel can handle jobs like this because of its unique composition. It contains free graphite, one of the best natural lubricants. This graphite gives Graph-Mo outstanding anti-friction properties and prevents scuffing and galling even in such difficult draws as this one.

Graph-Mo has a second great advantage over conventional tool steels: It outwears them on an average of three to one. Along with the graphite, Graph-Mo contains millions of tiny particles of diamond-hard carbides, one of the hardest-wearing substances known.

Despite its superior wear resistance, Graph-Mo machines about 30% easier than conventional tool steels. And it responds uniformly to heat treatment, thus requiring a minimum of grinding on the hardened dies.

Graph-Mo is one of four graphitic tool steels developed by the Timken Company. Would you like more information about their uses in dies, punches, gages and machine parts? Write for the new Timken Graphitic Steel Data Book just out. The Timken Roller Bearing Company, Steel & Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO."

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

MATERIAL: 11" dia. blank of 051" 2SO aluminum.

▲FIRST OPERATION: Draw a 5" dia. cup, 4½" high. At completion of the draw, but before retracting the punch, a ring is placed over the part which, when pressure is re-applied, trims the cup flange. The trimmed cup is stripped as the punch is retracted.

▶REDRAW OPERATION: One continuous draw forms the cup into a box, 3⅛" x 3½" x 5¾" high.

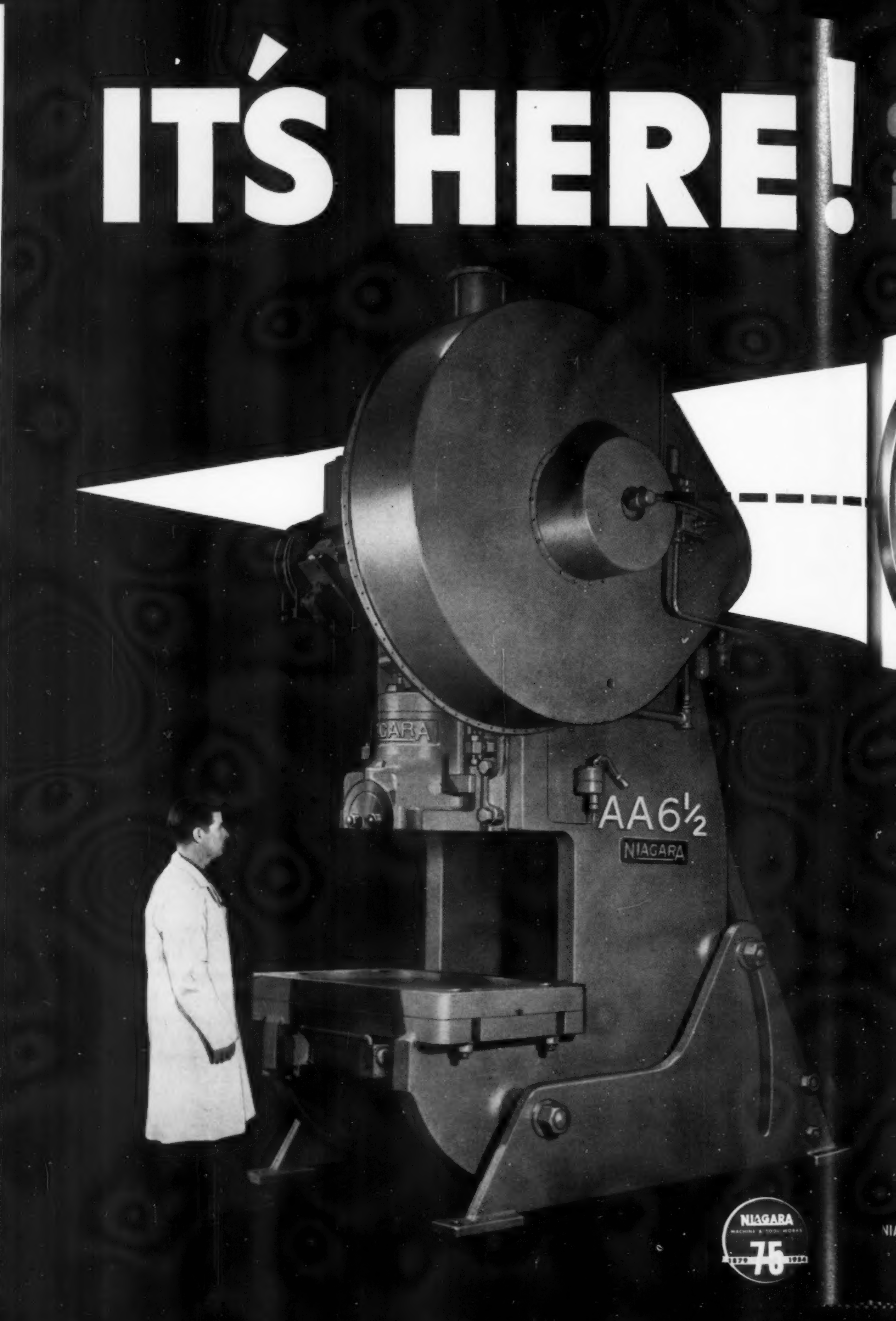
redrawing a round into a square by Hydroforming

Here's a dramatic, new *switch* to the "can't fit a square peg into a round hole" story . . . the Cincinnati 12″ Hydroform version: Draw a round cup, then redraw it, producing a deep, rectangular box!

Try this on your draw press in *two forming operations* . . . then compare your conventional tools—their cost and complexity—with these: A punch and a draw ring to produce the cup . . . a ring to trim the cup flange . . . a redraw sleeve with square opening, which is placed into the first operation draw ring to accommodate the predrawn cup . . . and a finish punch to form the box. Of these five, simple Hydroform tool elements, only the finish punch and the internal opening of the redraw sleeve could not be machined on a lathe.

This is another example of the *unique* drawing action—the *simplicity* and *economy* of tooling—the *savings* of operations—made possible by Hydroforming. Can your company use these Hydroforming advantages? Find out now, by calling in a Cincinnati Milling field engineer. For a description of the Hydroforming process and specifications of the 12″, 19″, 23″, 26″ and 32″ machine sizes, write for Bulletin M-1759-2.

CINCINNATI **Hydroform** **THE CINCINNATI MILLING MACHINE CO.**
CINCINNATI 9, OHIO, U.S.A.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Never before in O. B. I. Press history, has there been so significant a development as this new Niagara line . . . Series AA. Built in eight sizes, with shaft diameters from 3 to 7½ inches, it has set a new high for performance and stamina in blanking, forming, drawing, perforating, combination die and automatic feeding operations.

Get the complete story. Send for literature. Talk with our representative. SEE the press in action. Compare! Then, decide.

AND YOU'LL FIND ALL THE FACTS IN HERE!

BULLETIN 57-A
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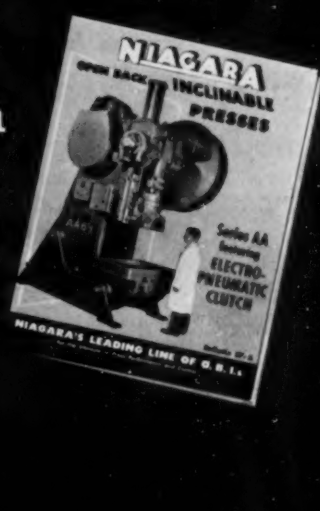

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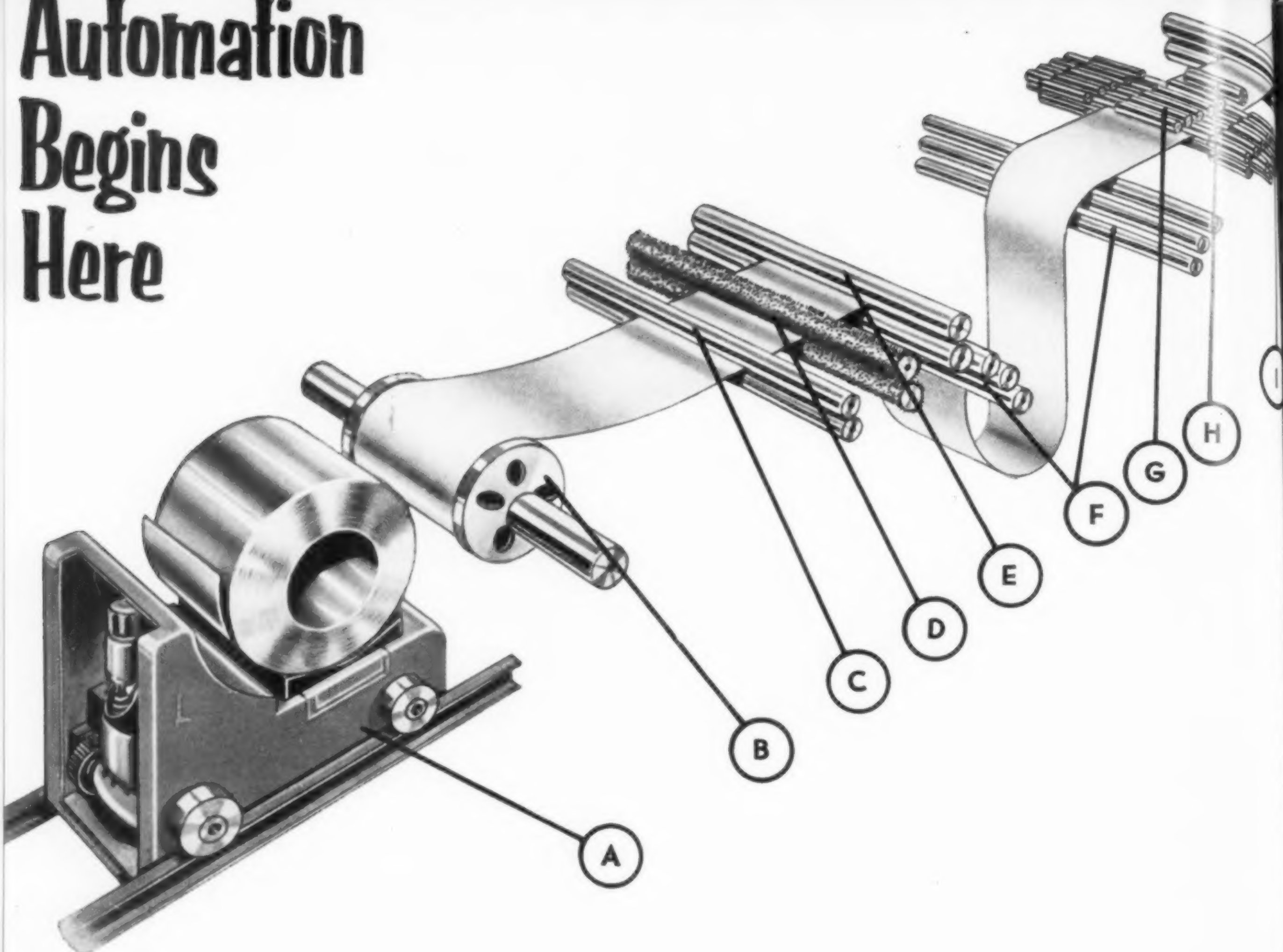
Automation Begins Here



Automation—the automatic handling of work in process — permits manufacturers to combat high labor and material costs by boosting man-hour production. McKay has played a large part in this movement by designing and building "automated" equipment for the automotive and steel fabricating industries.

For example, coil feed lines of the type illustrated above were designed and built by McKay for several leading automotive firms. They are used to automatically feed coil stock into square shears or blanking presses, thus eliminating inefficient and laborious methods of manually feeding these machines.

TYPICAL LINE EQUIPMENT

(A) Hydraulic Loading Car for stand-by coil.

(B) Cone Type Coil Holder handles wide range of co and O.D.'s.

(C) Guide Rolls to direct strip into brush rolls.

(D) Brush Rolls with solvent sprays to clean strip.

(E) Driven Pinch Rolls for pulling coil stock and storage loop.

(F) Guide Rolls to support loop.

(G, I, J & H) Feeder unit consisting of Backed-Up er **(G-I)** and pinch rolls **(J)** is powe D.C. drive which is controlled by a m ing device driven from measurin **(H)**. The feeder flattens the strip a curately measures it into open pre or through shear knives.

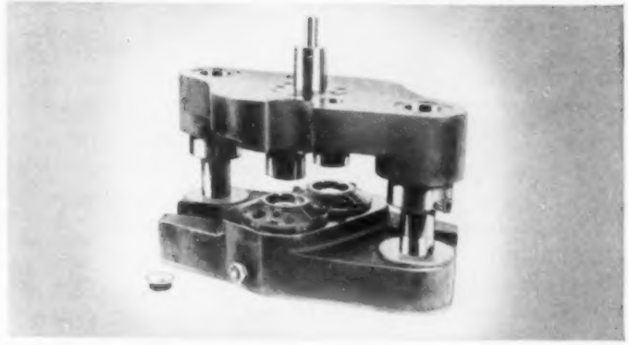
Line operation is synchronized with the press or she maximum production. McKay builds these units w sign, speed, and capacity dictated by your job requir

ENGINEERS AND DESIGNERS OF EQUIPMENT FOR THE AUTOMO FABRICATING AND STEEL IN

McK

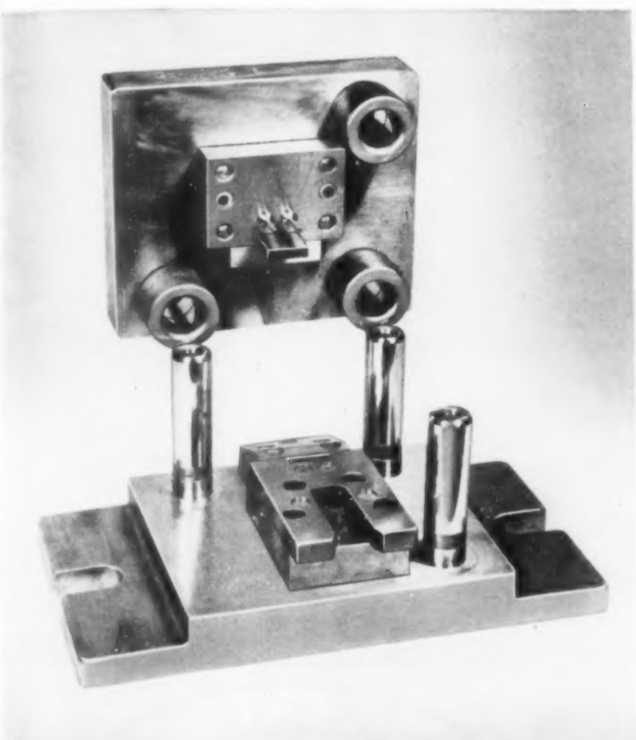
The McKAY MACHINE Company
YOUNGSTOWN, OHIO

1 Lamination die, made for Schick, Inc., produces rotor and stator laminations of motor-grade silicon steel. Customer reports carbide die produces average runs 35 times as long as steel dies.



2 Blanking and drawing of screw bottle caps is done by this die for Armstrong Cork Company, Lancaster, Pa. Die operated accurately on material .006" thick for months. Steel die had to be changed each week.

Case histories show how dies reduce costs when equipped with Carboloy® cemented carbide



3 Simple pierce and cutoff die, designed for Electric Auto-Lite Co., Toledo, operates at speeds faster than 400 strokes per minute. Die has produced over 2,000,000 strokes . . . and still does not require sharpening.

Actual plant performance has proved how easy and profitable it is to use Carboloy cemented carbide over a wide range of applications. For blanking, forming, drawing and piercing . . . for large or small, simple or complex dies . . . only carbides will give you benefits like these:

- **Production runs 35 times greater than steel (see picture No. 1)**
- **Accurate tolerances held for months . . . as compared to days with steel (see picture No. 2)**
- **Over two million high-speed strokes . . . without needing resharpening (see picture No. 3)**

If you wish, a member of the Carboloy Engineering Appraisal Service will call at your plant, without obligation. He'll show you how simple it is to wear-proof your dies; how to get increased production with fewer rejects. And you can send your key personnel to the Carboloy Die School in Detroit.

Also free is the Carboloy Die Engineering Manual D-124. It shows you how easy it is to design, apply and maintain carbide dies. For any of these free, cost-reducing Carboloy services or literature, send coupon below.

FILL OUT THIS COUPON—MAIL IT TODAY!

CARBOLOY Department of General Electric Company
11101 E. 8 Mile Ave., Detroit 32, Michigan

- ☐ Rush me free Carboloy Die Engineering Manual D-124.
- ☐ Send complete details on free Carboloy Die Training School.
- ☐ Have a representative of the Carboloy Engineering Appraisal Service call at my plant, at no obligation to me.

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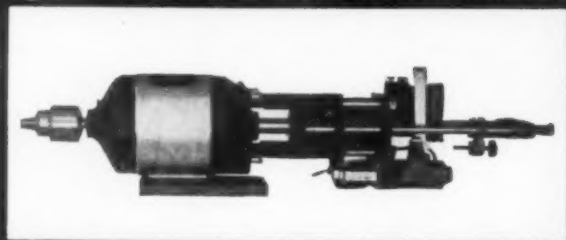
CARBOLOY

DEPARTMENT OF GENERAL ELECTRIC COMPANY

New BLACK SELF-CONTAINED DRILLING UNITS



NO SPLINES

NO GEARS

NO CAMS

NO CLUTCHES

NO REVOLVING WEIGHTS

Self-contained units, at low cost, for drilling, tapping, chamfering, reaming and similar operations.

New principle employs traversing motor shaft for work spindle, applies even torque with practically no end play. Drill has air feed for rapid advance to work—hydraulic control to completion of work cycle with uniform feed. Tapping unit controlled so tap follows its own lead without chamfering first thread or stripping threads on return stroke. Easy adjustment—depth accuracy to within .001".

Operate in any position. Wide range of speeds and sizes.

Write for complete information

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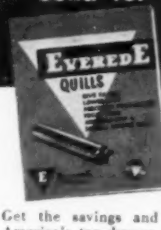
Send for this FREE BULLETIN GET MORE FROM YOUR PRODUCTION AND MULTI-STEP BORING BARS AND . . .

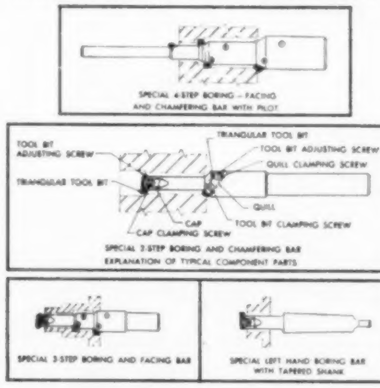


SAVE UP TO 70% IN TIME AND DIAMOND WHEEL WEAR, GRINDING TOOL BITS USE EVEREDE BORING BAR QUILLS

Get the savings and increased precision production which so many of America's top-drawer plants have standardized on: ADAPT EVEREDE SOLID TRIANGULAR TOOL BITS OF CARBIDE HSS, TANTUNG, OR STELLITE TO YOUR PRODUCTION AND MULTI-STEP BORING BARS . . . BY INSERTING THESE NEW EVEREDE QUILLS.

. . . they give you famed EVEREDE Boring, with the only boring bars using Pre-Formed, READY TO USE, Triangular-Shaped tool bits of Solid Carbide, HSS, Tantung or Stellite, with rake and clearance angles automatically provided.

WIDE RANGE OF SIZES & DIAMETERS



Quills are available in wide range of sizes, diameters and lengths. Easily inserted into boring bars. "V"-shaped nest for Triangular Tool Bit eliminates side-creep. Back-up prevented by back-up and adjusting screws supplied with the Quill. Precision relocation of Tool Bits after sharpening is simplified by "V"-shaped Tool bit nesting. This nesting automatically provides distance between multiple Tool Bits when they are set to bore the correct diameters.

It will pay you to get all the free details . . . just write for EVEREDE QUILL BULLETIN or attach this advertisement to your letterhead and mail to us.

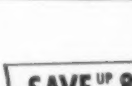
SPECIAL BORING BARS MADE TO YOUR SPECS

Complete facilities. Free estimates. Send drawings or sketches of parts or tools.

EVEREDE TOOL CO.
2000 N. PARKSIDE AVE.
CHICAGO 39, ILL.

USE READER SERVICE CARD; INDICATE A-2-230-3

SAVE UP TO 85% ON GOVERNMENT SURPLUS



MAGNI-FOCUSER

Has fine ground lenses of optical glass. Neutralizes eye strain from close work. Binocular design gives third dimensional vision. Allows freedom of both hands. Wear over glasses. Plastic frame with adjustable headband.

SIZES: 20" focal lgth. 1½ power—14" focal lgth., 1¾ power, 10" focal lgth., 2¼ power; 8" focal lgth., 2¾ power . . . . . . price each ONLY 10⁵⁰

HYDRAULIC EQUIPMENT

We stock over 100,000 Hydraulic Cylinders in 106 different types and sizes. These can be adapted wherever tremendous power is needed to push, pull, hoist, mould or drive, etc.

SPECIAL

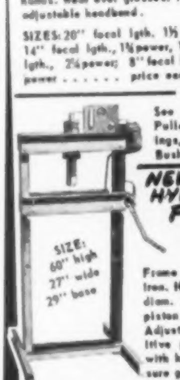
Gives 20,000 lb. thrust using 1500 PSI line pressure as obtained from our hydraulic pumps. Will produce up to 40,000 lb. thrust with 3000 PSI. Can also be used on a low pressure air system. Has 4" bore; 18" stroke; 30½" long. Ideal for shop.

USED 29⁹⁵

Part No. 29 NEW $43⁹⁵

OTC TOOLS

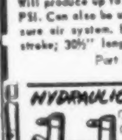
See our complete line. Pullers for Gears, Bearings, Wheels, Pulleys, Bushings, Shafts, etc.



NEW 10 TON HYDRAULIC PRESS

Use this Press in the Shop or take it with you on the job. Frame is 4" welded channel iron. Has 4⅛" stroke, 2½" diam. ram. Valve operates piston in both directions. Adjustable platform. Positive power Hand Pump with handle. 2000 PSI pressure gauge. 129⁰⁰

HYDRAULIC HAND PUMP

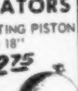


Operating pressure 1500 PSI. Cap., 1.5 cu. in per complete cycle . . . 12⁷⁵

HYDRAULIC ACCUMULATORS

A-2B FLOATING PISTON TYPE – 4"x 18" Built to stand 2,000 PSI 12⁷⁵

A-5 VICKERS – 10" dia. Ball type. Built to stand 2000 P.S.I. 24⁵⁰



NOTE: Stocks include bargains in Hydraulic Pumps – Valves – Motors – Boosters – as well as Oil, Water and Fuel Pumps, etc.

WORLD'S MOST AMAZING BARGAIN CATALOG

320 PAGE-1954 EDITION

Packed with SENSATIONAL VALUES in GOV'T SURPLUS – FACTORY CLOSE-OUTS – and GENERAL MERCHANDISE. Fully priced and illustrated. Thousands of items in Machine and Industrial Tools – Hydraulic Equipment such as Cylinders, Pumps, Valves, Motors, Fittings, etc. Bargains in Electric Motors, Generators, Blowers, Parts, etc. Also Hand and Power tools, Precision Instruments, Bearings, Hose Clamps, Winches, Foam Rubber, Microscopes, etc. ALL AT PALLEY BARGAIN PRICES – PRICED TO SELL!

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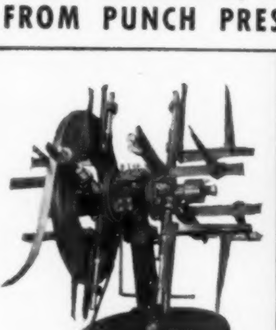
LESS DOWN TIME, MORE PRODUCTION FROM PUNCH PRESSES FED BY



LITTELL DOUBLE AUTOMATIC CENTERING REELS

Vital minutes are saved, with practically no down time for coil replacement, when a Littell Double Reel uncoils stock to the punch press. The idle side of the reel is loaded while the other side pays out. When a coil is used up, the operator simply lifts the hub lock pin, then swivels the reel 180°, thus placing the reserve coil in press feeding position. The change-over is complete in a few seconds. Like Littell Single Reels, Littell Double Reels combine balance that means smooth running accuracy with rugged malleable iron and steel construction that assures year in, year out dependability.

FOUR SIZES

No. 3—for coils up to 300 lbs.
No. 5*—for coils up to 600 lbs.
No. 10*—for coils up to 1,000 lbs.
No. 25*—for coils up to 2,500 lbs.
*Can be furnished with motor drive

Write for catalog

F. J. LITTELL MACHINE CO. Speed with Safety

ROLL FEEDS • DIAL FEEDS
STRAIGHTENING MACHINES
REELS • AIR BLAST VALVES
District Offices: Detroit, Cleveland

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USE READER SERVICE CARD; INDICATE A-2-230-4

Announcing . . . . .

a New addition to our popular line of **SELECTIVE FEEDING DEVICES**

NOW! A FEEDING UNIT FOR ALMOST ANY SPECIFIC APPLICATION!

Also **EXTENDED ENGINEERING SERVICE—**

ENABLING US TO DO THE COMPLETE TOOLING FOR YOUR INDIVIDUAL FEEDING OPERATIONS

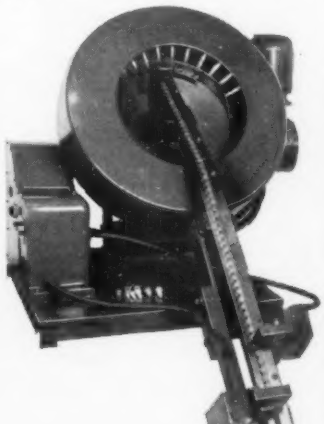
New!

DPS BOWL-FEEDER

A proved method based on the VIBRATORY PRINCIPLE. Provides fully automatic, oriented, single line feeding to Grinding, Packaging, Inspecting and many other automatic machines and operations. Will scientifically feed light, fragile parts that normally could not withstand tumbling.

DPS BARREL-FEEDER

For years our popular unit, successfully used in thousands of plants to help speed production and reduce costs. They were designed with the idea of simplicity in operation and maximum feeding, handling a wide variety of parts. Designed for constant operation.



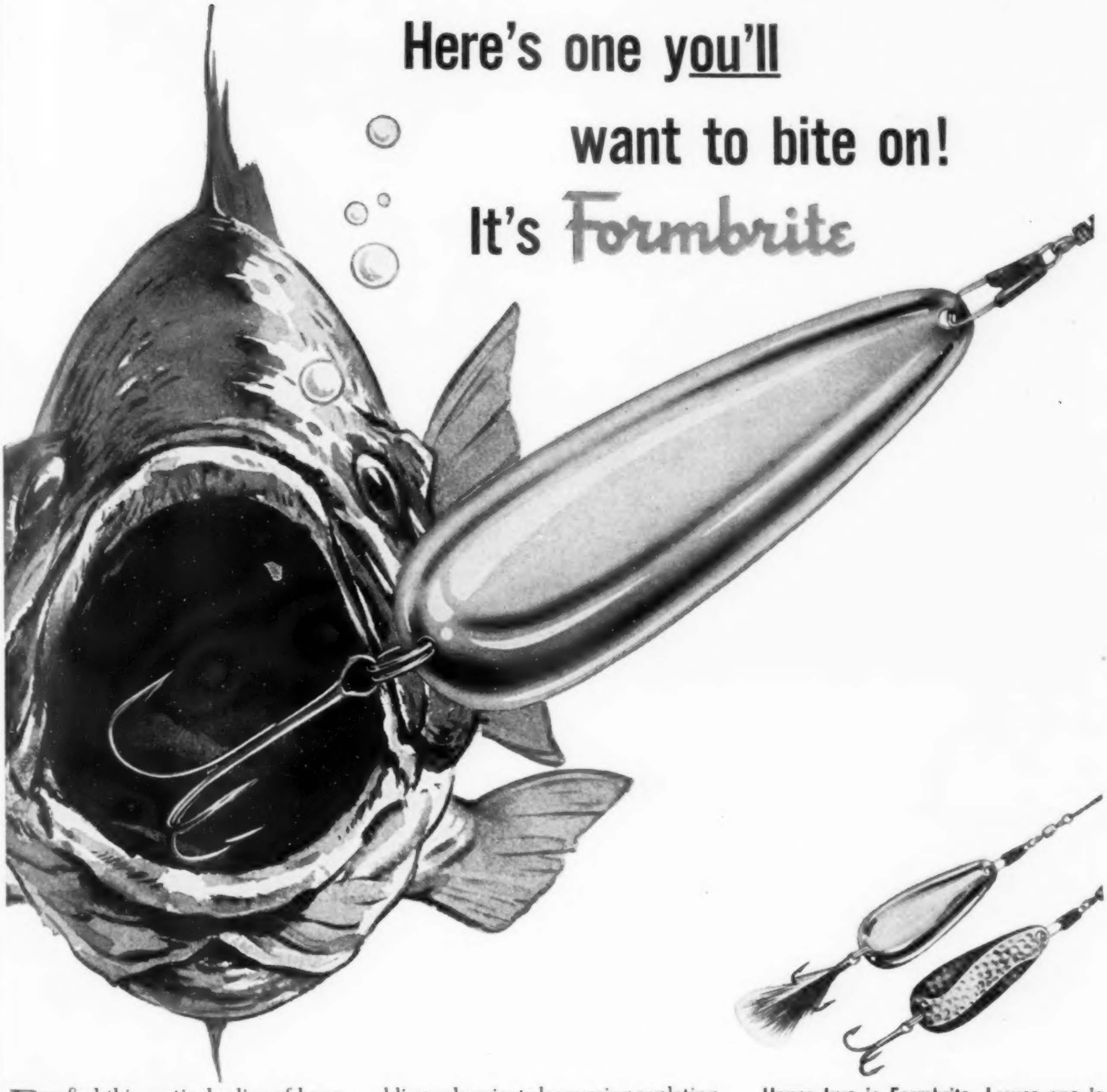
Write Us—Give Details and learn how our trained engineers can supply the answer to your feeding requirements.

DETROIT POWER SCREWDRIVER CO.

2799-A W. FORT STREET, DETROIT 16, MICHIGAN

Here's one you'll want to bite on!

It's Formbrite



Upper lure is Formbrite. Lower one is made of ANACONDA Fancy Pattern Embossed Brass.

FISH find this particular line of brass spinners so attractive that fishermen's demands have built annual sales of the Aeroplane Tackle Manufacturing Company of Denver to more than two million lures of all types.

The high finish on the spinner is part of the secret. While the cost of producing this is of no interest to the fish, it is to the manufacturer. Recently all brass orders were changed to Formbrite*, the superior ANACONDA Drawing Brass that has enabled this firm to cut polishing costs over 25%, and on several stamped products to produce the required finish by tumbling only prior to lacquering or plating.

Formbrite, with its superfine grain, provides a surface far superior to ordinary drawing brass. It is stronger, harder, more scratch-resistant than ordinary brass, yet retains remarkable ductility for forming and drawing. It's a premium product at a non-premium price. If these features lure you, we should like to show you how this better brass can cut your product's finishing costs. Or write for Publication B-39 to *The American Brass Company, General Offices, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Limited, New Toronto, Ontario.*

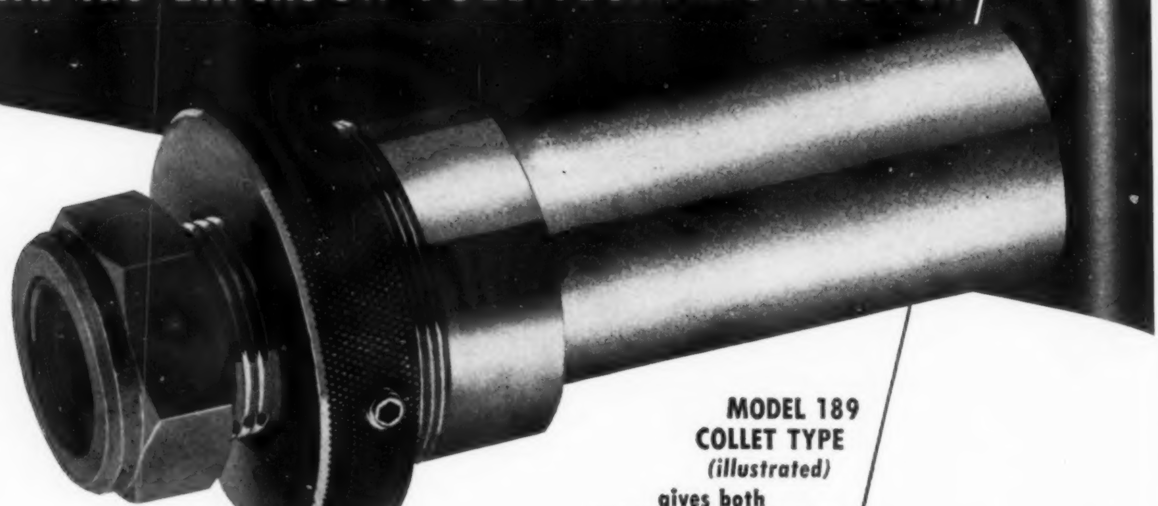
Thirty-five years ago a fisherman, disgusted with his luck, cut up an old brass bait box to make himself a spinner resembling an old-time airplane propeller. Both fish and fisherman liked it so much, he started what is now a big and thriving business.

*Reg. U. S. Pat. Off. 5392

DRAWING BRASS

An ANACONDA® product made by The American Brass Company

Correct MISALIGNMENT
with the ERICKSON FULL FLOATING HOLDER



MODEL 189
COLLET TYPE
(illustrated)
gives both
PARALLEL ADJUSTMENT
and ANGULAR ADJUSTMENT

With the Full Floating Holder, another of the Erickson family of Precision Holding Tools, work and cutting tools may be quickly and easily adjusted to offset machine errors.

This Precision Holder compensates for *both* parallel and angular misalignment with the work spindle through the use of mechanical principles never before utilized in any floating holder.

Designed for floating reamers, taps, die-heads and all other chuck-held cutting tools, the versatile Erickson Full Floating Holder will help you increase production, reduce scrap, and lower tooling costs. A-6094

Available in Taper, Bushing and Erickson Collet Types

Write for Catalog Today

Catalog A: *Precision Collet Chucks*

Catalog B: *Adjustable and Full Floating Holders*

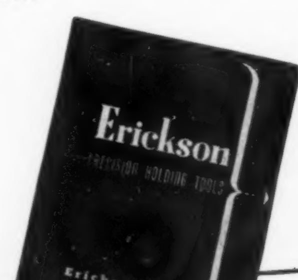
Catalog C: *Precision Tap Chucks*

Catalog D: *Speed Chucks and Air Operated Cylinders*

Catalog E: *Precision Expanding Mandrels*

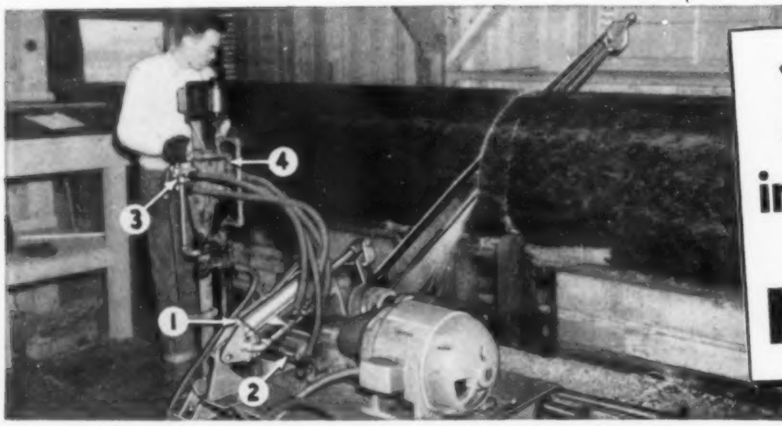
Catalog F: *Speed Indexers*

Catalog G: *Boring and Reaming Tools*



ERICKSON TOOL COMPANY

2316N HAMILTON AVE. CLEVELAND 14, OHIO



2 Vital Movements in Deck Saw Operation Powered by NOPAK Cylinders

Arrow No. 1 — NOPAK 6"x14" Model E Cylinder
Arrow No. 2 — NOPAK 4"x10" Model E Cylinder
Arrow No. 3 and No. 4—NOPAK ½" 4-Way Valve

•

Refer to Sweet's File for Product Designers or write for Bulletin SW-2.

This carriage-type deck saw, designed and built by Elk Lumber Co. Medford, Ore., eliminates mis-cutting, and short logs reaching the carriage.

The 8 foot chain-saw bar is raised and lowered by a NOPAK Model E, 6" x 14" Air Cylinder. Horizontal carriage movement of 10", powered by a NOPAK 4"x10" Air Cylinder, permits operator to locate saw accurately to cut logs within minimum tolerance of ½". Both movements are controlled by NOPAK valves mounted at operator's station.

This is typical of hundreds of machine movements in which NOPAK Cylinders and Valves are used in all types of industry. For others, see the NOPAK Application Manual.

GALLAND-HENNING NOPAK DIVISION
2750 S. 31st STREET • MILWAUKEE 46, WISCONSIN

NOPAK
VALVES AND CYLINDERS
DESIGNED for AIR and HYDRAULIC SERVICE
Representatives in Principal Cities

A 7702-½-H

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When you "SAVE"... YOU LOSE!

"Saving" by making your own punches is old-fashioned and expensive.

Check your labor costs — your "down-time"— and order

PORTER PUNCHES

— for immediate delivery. Save time — save money — with top quality punches and die buttons. Look to Porter for

the punch you need... when you need it!

Remember — you don't save by making your own punches — you *lose*.

3P

"Still the best performer"

Here's why:

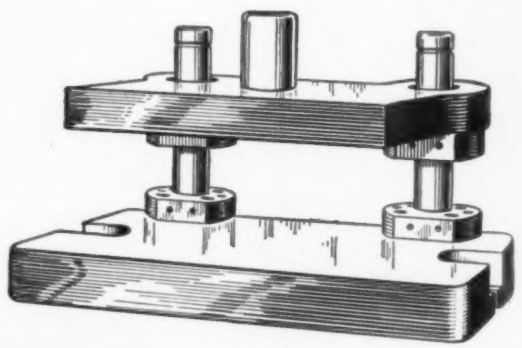
1. PORTER PUNCHES are available for immediate delivery.
   ... they save time — money — by keeping your expensive help at profitable jobs.
2. PORTER PUNCHES are made to "stand the gaff."
   ... punches made in your shop are probably made from "available" material .. often the wrong metal for the job.
3. PORTER PUNCHES are offered in standard—and decimal sizes.
   ... so your experienced help doesn't spend costly time "whittling."
4. PORTER PUNCHES are reasonably priced.
   ... only a "specialist" can make punches as well—or as inexpensively.

PORTER PRECISION PRODUCTS

PRinceton 6338 P.O. Box 99 Cincinnati 31, Ohio

Porter Punches are in stock in all principal cities. Send for complete catalog and prices—today!


Morton
4



At Orange Screen Co., with an output of 900 pieces per hour, cost of making mitre cuts on aluminum frames on double Delta cut-off saws is only 2.9 cents each, including all charges for depreciation, interest on investment in tools, maintenance, power and labor.

DELTA Cut-Off Saws mitre-cut aluminum frames for 2.9¢* each

*Includes all charges for depreciation, interest on investment in tools, maintenance, power and labor

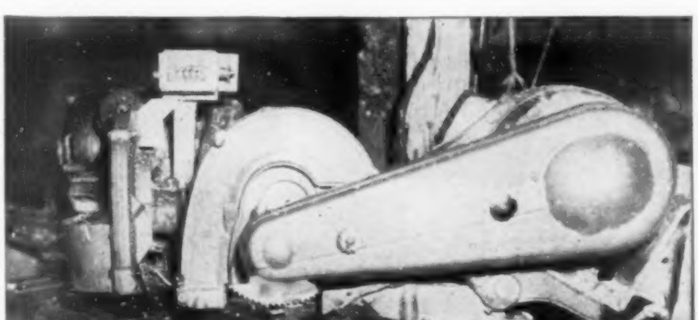
HERE'S HOW ORANGE SCREEN CO. SAVES

Delta abrasive cut-off saws set in pairs and specially tooled make the mitre cuts on both ends of aluminum window frame members at the same time at a cost of 2.9 cents per piece at the Orange Screen Co., Dover, N. J.

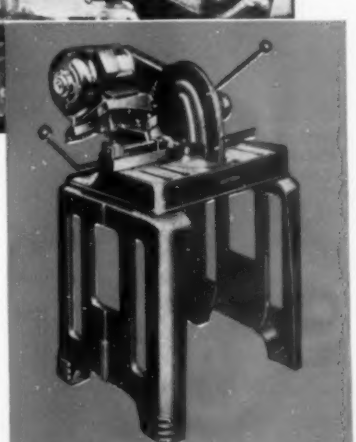
Says E. J. Belliveau, chief manufacturing engineer: *"These set-ups have worked like a charm for nine years. We need their high speed —4000 rpm spindle speed and 10,500 fpm surface speed. An operator—man or woman—can feed an 18' extrusion ½" x ⅜" up to 3" x 1" and turn out 900 pieces per hour. In spite of this fast pace, women operators regularly get incentive production 30 to 80 per cent above base.*

"As a matter of fact, we've standardized on Delta tools all over the plant. Our Delta tools—20 cut-off machines, 27 drill presses, 3 belt sanders, 5 band saws and 2 circular saws—all have a fine record for accuracy, and with their small initial cost and long life, depreciation is extremely low."

There it is—history repeating itself. Another alert management that's found that low-cost, adaptable, accurate Delta tools out-produce and out-profit far more costly tools. It's easy to find out how you, too, can get these production savings. Talk to your Delta dealer listed in the yellow pages of your phone book under "Tools" or "Machinery." And send for the most useful tool catalog you can have in your desk—Delta AB-Catalog. Delta Power Tool Division, Rockwell Manufacturing Co., 620B North Lexington Ave., Pittsburgh 8, Pa.



Orange Screen Co. keeps blades sharp, uses 10" steel blades that average 36,000 cuts between sharpenings. Maintenance in nine years has been negligible, they report.



DELTA MILWAUKEE

DELTA QUALITY MAKES THE DIFFERENCE

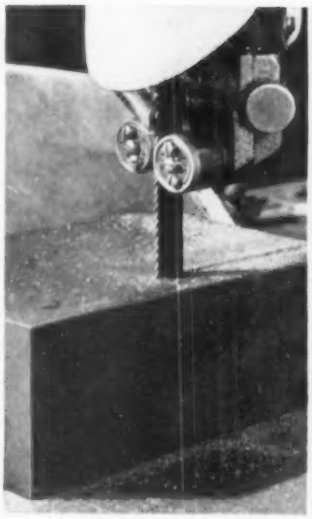
DELTA QUALITY POWER TOOLS

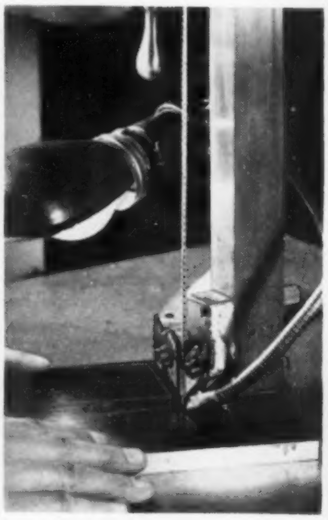
Another Product of **Rockwell**

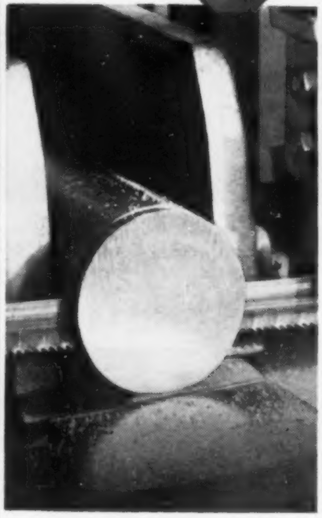
Pick the Top

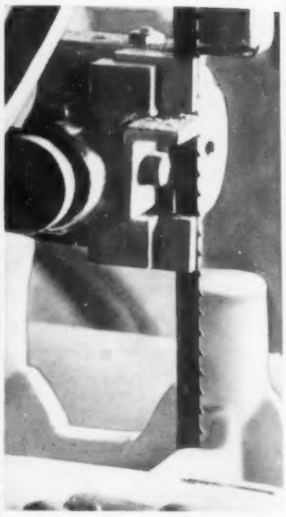
"NAME BAND"

for all these Metal-Sawing Jobs









For Heavy Production Cutting

You'll like this rugged, break-resistant standard tooth blade for trimming gates and risers off castings, cutting metal bars and other tough production work. Hardened along the tooth edge only, it cuts fast, stays sharp, gives a longer run for your money! All standard widths and tooth spacings. Furnished in 100′ and 300′ coils or welded to length for specific machines.

For Contour Cutting and Die Making

In the narrower widths, this edge-holding, smooth cutting blade is an outstanding favorite for contour work. Because the teeth are set with absolute evenness on both sides of the blade, you can depend on straight, on-the-line cuts with no "leading." All standard widths and tooth spacings furnished in 100′ and 300′ coils or welded to specified length.

For Horizontal Cut-Off Work

Furnished either Regular or Wavy Set in the wider widths, this Simonds-made standard tooth blade easily handles the wide variety of cutting required in general shop and steel warehouse operation. All sizes come in 100′ and 300′ coils or welded to length.

For Cutting Soft Materials

This Skip-Tooth Hard Edge Blade has extra gullet capacity with maximum blade strength . . . gives fast, trouble-free service in cutting aluminum, magnesium, plastics, plywood and hardwood. All standard sizes available in 100′ and 300′ coils or welded to length for specific machines.

Get Delivery From Stock From Your Industrial Supply Distributor

SIMONDS SAW AND STEEL CO.
FITCHBURG, MASS.

Factory Branches in Boston, Chicago, San Francisco and Portland, Oregon.
Canadian Factory in Montreal, Que. • Simonds Divisions: Simonds Steel Mill, Lockport, N. Y.
Simonds Abrasive Co., Phila., Pa. and Arvida, Que., Canada

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-244

IN THIS NEWLY designed die casting machine (Fig. 1), built by Cuyahoga Industries, Inc., Cleveland, Ohio, parts required to provide top quality, maximum engineering properties, are Meehanite metal.

As can be seen from the parts indicated (Figs. 1 & 2), such castings must be dense, uniform, free from defects, rigid, strong, and tough. Because of the unique control processes used in the manufacture of Meehanite metal, these engineering characteristics are achieved in the right combination for the application.

Designers and manufacturers of machinery and machine tools have developed a confidence born of years of success with Meehanite components and turn to them regularly to solve every important design problem.

Consult your Meehanite foundry FIRST for engineering service and assistance, and ask for a copy of the new 24 page bulletin "Meehanite Castings Build BETTER Machine Tools".

MEEHANITE®

NEW ROCHELLE, NEW YORK

MEEHANITE MEANS BETTER CASTINGS

"Only a *Meehanite* Foundry Can Make *Meehanite* Castings"

American Brake Shoe Co. .... Mahwah, New Jersey
The American Laundry Machinery Co. .... Rochester, New York
Atlas Foundry Co. .... Detroit, Michigan
Banner Iron Works .... St. Louis, Missouri
Barnett Foundry & Machine Co. ...... Irvington and Dover, New Jersey
E. W. Bliss Co. .... Hastings, Mich. and Toledo, O.
Builders Iron Foundry .... Providence, Rhode Island
Compton Foundry .... Compton, Calif.
Continental Gin Co. .... Birmingham, Alabama
The Cooper-Bessemer Corp. ...... Mt. Vernon, Ohio and Grove City, Pa.
Crawford & Doherty Foundry Co. .... Portland, Oregon
DeLaval Steam Turbine .... Trenton, N. J.
M. H. Detrick Co. .... Newark, N. J. and Peoria, Ill.
Empire Pattern & Foundry Co. .... Tulsa, Oklahoma
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Greenlee Foundry Co. .... Chicago, Illinois
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Standard Foundry Co. .... Worcester, Massachusetts
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"This advertisement sponsored by foundries listed above."

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-246

GREENLEE *Automatics*

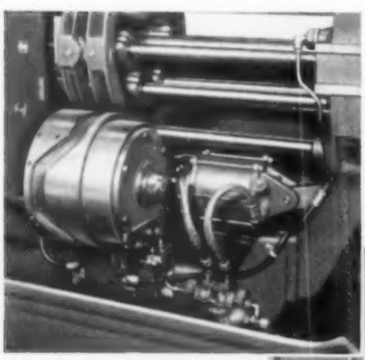
Close-up of the rear stock reel support, showing a piston (which follows and pushes the stock) being inserted in a stock tube. The air hoses are equipped with speed couplers.

AIR-FEED

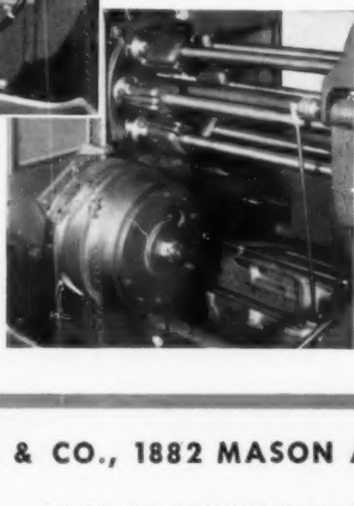
(PNEUMATIC STOCK FEED)

- FEEDS OUT STOCK TO 16½″
- PROVIDES MULTIPLE FEED-OUT
- ELIMINATES STOCK SCORING
- REDUCES STOCK REEL NOISE
- ELIMINATES STOCK PUSHERS
- ELIMINATES FEED-OUT CAMS

This method of feeding out stock was developed primarily for the many screw machine jobs that require either multiple feed-out arrangements, greater feed-out length than the conventional mechanical arrangement will permit, or for machining parts made from ground stock where pusher marks would be objectionable. It can be adapted to all 1″ and 1⅝″ GREENLEE Automatics.



Left: One method of opening and closing the collets for multiple feed-out. The air cylinder, controlled by a plate cam on the cam drum, actuates the collet-operating rings. Various arrangements can be made, depending on the requirements of the particular job being set up.



Right: Simplification of the feed cam drum possible with air feed, where the collets are to be opened by the conventional mechanical arrangement between the 6th and 1st positions. Feed-out is usually against a standard fixed stock stop in such cases.

Above: A method used for feeding out stock during the machining cycle. The stock is fed out against an adjustable live-center stock-stop arrangement. When the collet jaws are closed, the live-center retracts and permits the stock to rotate freely and index to the next position.

Write for Free Literature

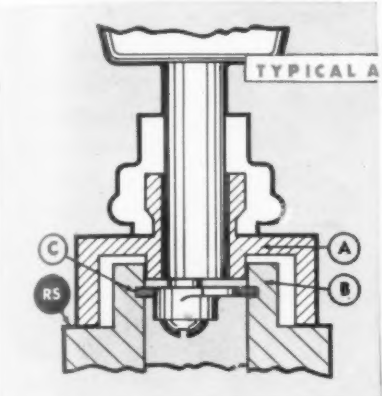
PRODUCTION MACHINERY GREENLEE

GREENLEE BROS. & CO., 1882 MASON AVE., ROCKFORD, ILL.

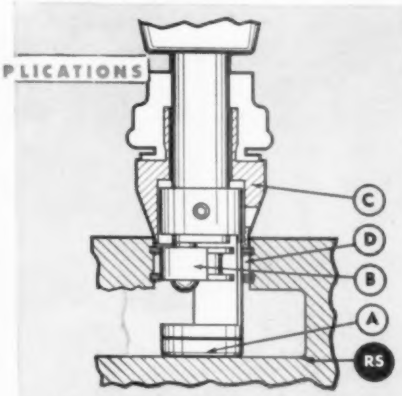
Waldes Truarc Grooving Tool Out-Performs Conventional Recessing Tools

SAVES TIME! CUTS COSTS! NEEDS NO SKILLED LABOR!

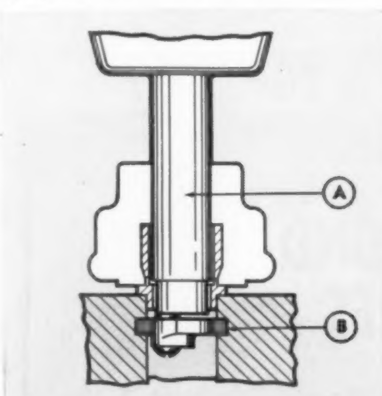
TYPICAL APPLICATIONS



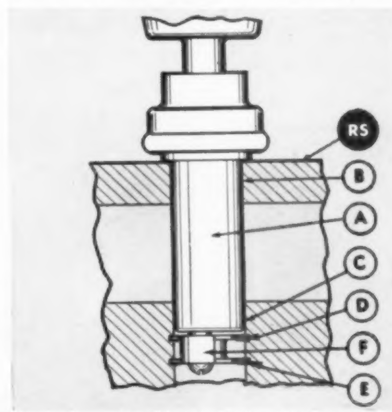
Clearing Obstructions or Protrusions — Waldes Truarc Grooving Tool with *special bushing* with high shoulder A in order to clear obstruction B on reference surface RS so groove can be properly located in bore.



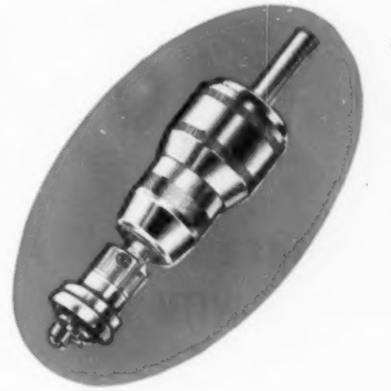
Locating Grooves from Bottom of Hole or Blind Hole—Use of *bottom adaptor* A and double cutter B. Bushing C pilots tool into bore D while bottom adaptor acts as stop to locate grooves from reference surfaces RS below bore.



Small Diameter Bore — Need for Wide Groove —Great versatility of tools allows A-2 Tool to accept *stepped down spindle* and *cutter-shaft* assembly A. Provides cutting capacity in a bore normally within the range of smaller A-1 Tool. Illustrated, larger tool capacity necessary to cut groove diameter B exceeding normal capacity of standard A-1 Tool.



Extending Reach of Tool — Waldes Truarc Grooving Tool assembled with *extended bushing* A increases normal range of tool in order to reach proper groove location in bore. Bushing also registers on reference surface RS of workpiece while piloting tool at two points B and C inside bore. Two grooves D and E are cut simultaneously with double cutter F.



AMAZINGLY VERSATILE! The Waldes Truarc Grooving Tool adapts quickly and simply to your toughest recessing requirements. With it, even *unskilled labor* can perform and maintain high precision, mass production operations.

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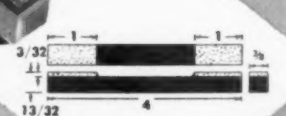

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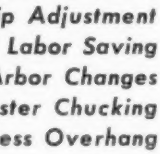

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Plain Pointers on Projection

MOST optical textbooks mention the French physicist Augustin Jean Fresnel in connection with his work in helping to establish the wave theory of light. However, Fresnel also contributed greatly to the design of optics used for lighthouses. His work in this field, which forms the basis upon which lighthouse opticians still work, has led to the coupling of his name with a distinctive "flat" lens type.

At first glance this might seem removed from the field of optical gaging and the use of contour projectors throughout industry. The truth of the matter is, however, just the opposite. In designing the Kodak Contour Projector, our optical engineers have included a Fresnel lens directly behind the instrument's ground-glass screen.

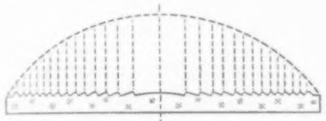

Fig. 1. Steps of the Fresnel lens duplicate the curvature of conventional condensers, making it possible to "collapse" a lens into a flat plane.

This flat plastic lens is illustrated schematically above (Fig. 1). In effect, a curved surface is collapsed into a series of minute steps which reduce the mass of the lens to a practical size. A conventional lens used for the same purpose, of diameter to equal the projector screen, would be more than 5" thick, heavy, and not inexpensive.

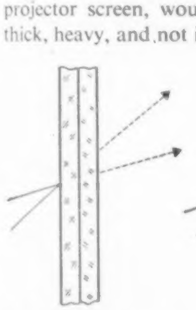

Fig. 2. Diffusing properties of ground-glass screen scatter oblique light away from viewer's eye.

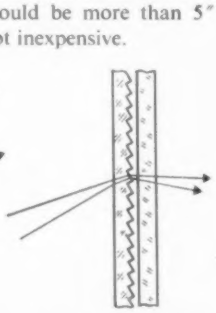

Fig. 3. Fresnel lens behind ground-glass screen directs oblique light towards viewer.

Use of the Fresnel lens in this manner serves a double purpose: 1) it effectively increases screen brilliance by directing the light on the screen directly at the operator's position; and 2) it provides even illumination over the entire screen area.

Because of this our projectors may be used under normal shop illumination without hoods or curtains—both of which sometimes tend to give a feeling of claustrophobia. In addition, the over-all screen brilliance makes possible easy reading of critical tolerances at any point on the projector screen. Together, these attributes tend to make your personnel more contented and efficient . . . help to make contour projection suited to mass inspection needs.

How rapid, accurate inspection on Kodak Contour Projectors keeps a production line moving

When you receive a great many precision parts from a great many suppliers, quality control checks can be a real production bottleneck.

At General Electric's jet engine plant at Cincinnati, Ohio, engineers have solved one such problem using Kodak Contour Projectors. Rotor blades arriving in lots of 2000 to 5000 are given a 4 per cent AQL check by the young ladies seated above. Eleven dimensions, including angles and radii, are checked on the dovetail contour, and 14 different dimensions checked on the rotor blade root—all at a rate of approximately 150 pieces per hour. Optical gaging has lightened the load, reduces inspection time, helps to keep the production line moving.

The Kodak Contour Projector is particularly suitable for such routine production inspection. It requires no hoods, curtains, or darkened room (the column at the left tells you why). Operators work rapidly and accurately in comfort—require little training. And, simply by changing chart-gages and staging fixtures, all sorts of complex parts, large and small, can be inspected.

To find out more about the Kodak Contour Projector and how it can work for you, send for our 12-page booklet. Or, write for details on a sound movie, "Optical Gaging."

the KODAK CONTOUR PROJECTOR

44

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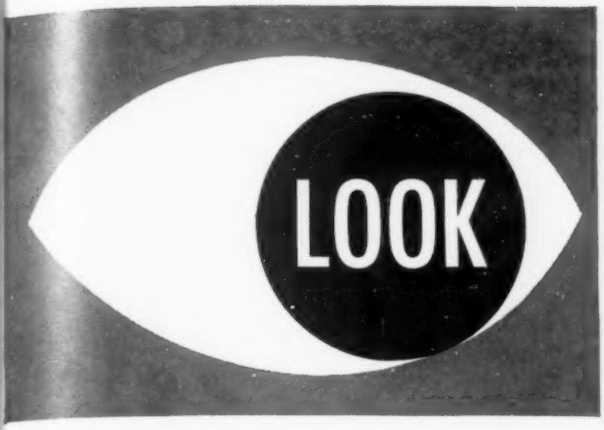

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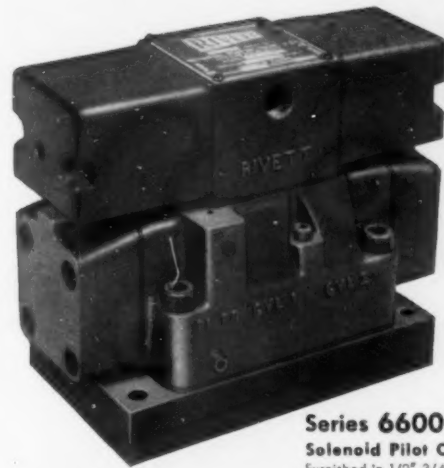

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A case history of Lindberg Steel Treating Co. service to American industry

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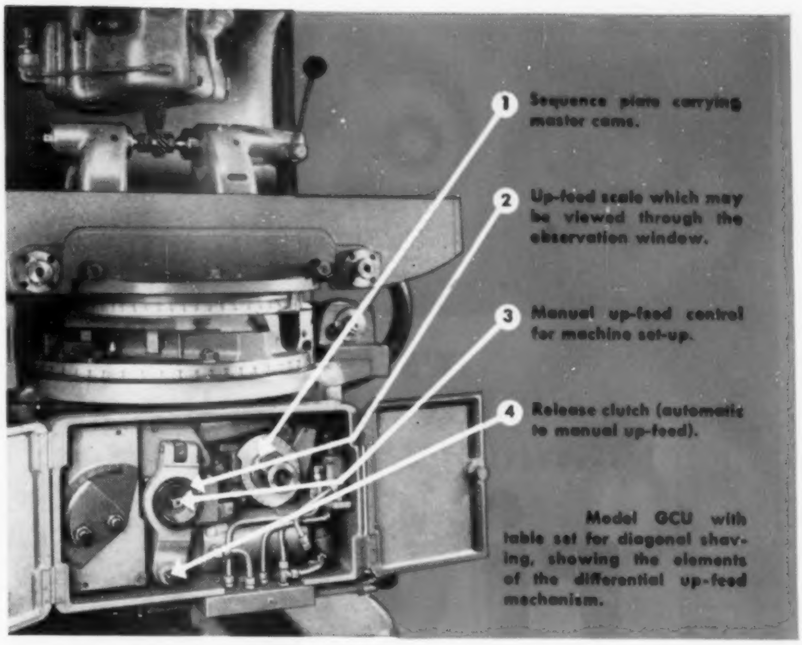


1 Sequence plate carrying master cams.

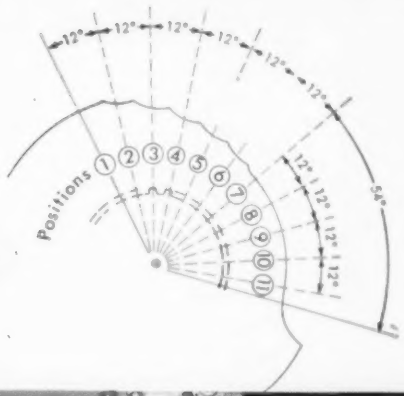
2 Up-feed scale which may be viewed through the observation window.

3 Manual up-feed control for machine set-up.

4 Release clutch (automatic to manual up-feed).

Model GCU with table set for diagonal shaving, showing the elements of the differential up-feed mechanism.

When Automatic Differential Up-feed and Conventional Crowning were added to the Red Ring Model GCU, shaving speed, flexibility and economy were all significantly increased.



One of the two control cams carried by the feed unit sequence plate.

AUTOMATIC DIFFERENTIAL UP-FEED

This efficient device provides for the first time an automatic cycle applicable to both diagonal and conventional shaving. This cycle is controlled by an eleven-position master cam. Included are backlash take-up, infeed cutting strokes, idling strokes and return to unloading backlash. The entire cycle or any portion of it may be used depending on job requirements.

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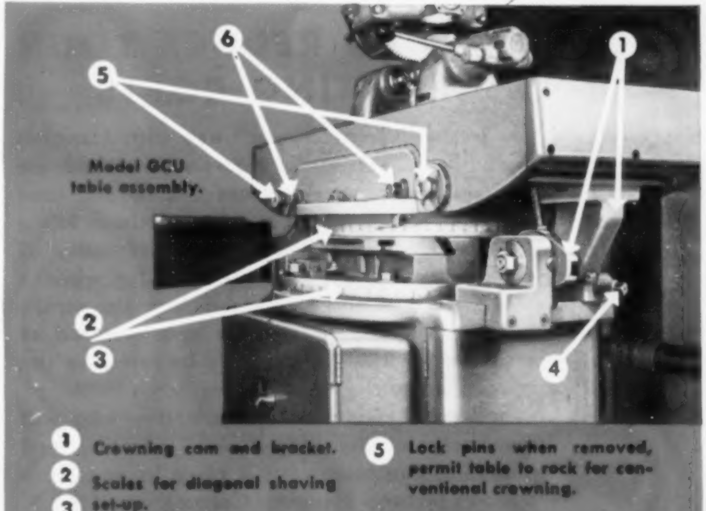


Model GCU table assembly.

1 Crowning cam and bracket.

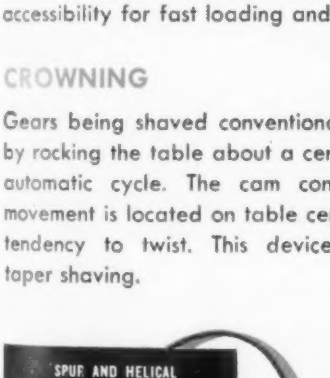
2, 3 Scales for diagonal shaving set-up.

4 One of 2 tapered shot bolts used to realign table and ways for conventional shaving.

5 Lock pins when removed, permit table to rock for conventional crowning.

6 Bolts operated from the front of the machine actuate tapered wedges to lock table to the ways.

Write for Bulletin S53-7 for full details.



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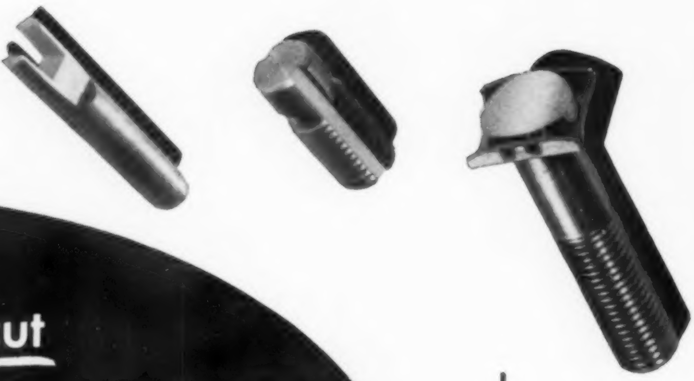

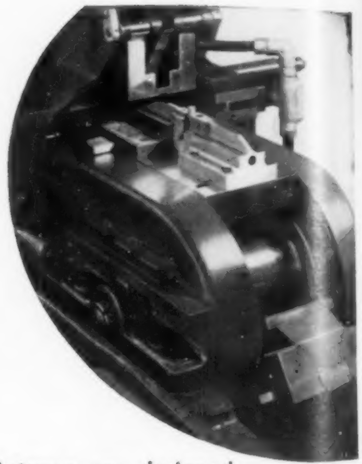

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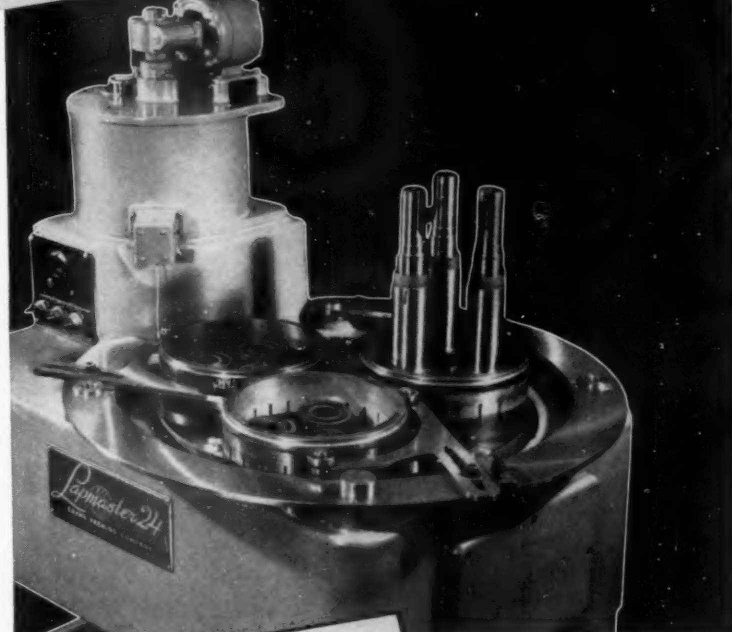
WITH A LAPMASTER



Here is the machine to do the job if you want precision flatness in production quantities at an economical rate. Lapmaster machines readily lap to the extreme close tolerance of one light band (0000116″) or less. In addition, they produce an extremely fine finish to as low as 1 RMS.

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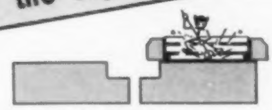
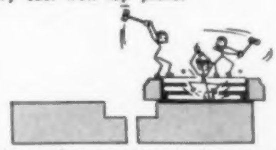
1. Operator requires no previous lapping experience.
2. Automatic timer provides controlled lapping cycle for production efficiency and allows time for pre-loading work-holders.
3. Simplicity of design allows ease of loading and unloading.
4. Loose abrasive distributed evenly over lapping area insures uniform results.
5. Serrated lap plate collects and disposes of spent compound and removed stock.
6. Precision laps identical parts or parts of various shapes, heights and materials in one cycle.
7. Self-conditioning lap plate eliminates down time for truing or replacement.

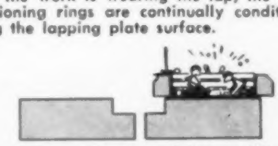
How the Lapmaster Works



The work being lapped causes wear on heavy cast iron lap plate.



As the work is wearing the lap, the conditioning rings are continually conditioning the lapping plate surface.



Since the wear action of the conditioning rings is greater than the wear caused by the work being lapped, the flatness of the lap plate is automatically maintained.

FREE DATA

Learn more about the possibilities of production lapping and the interesting subject of measuring flatness. The illustrated fact-filled booklets are yours for the asking. Write today.

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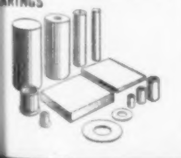
4. **LOWER COST.** Longest service life assured by BOSTON Gear quality.
5. **WIDER RANGE** of standard types and sizes. REDUCTORS. 005 hp to 36 hp — RATIOMOTORS 32 types, 1/20 hp to 3 hp
6. **NEARBY STOCKS** at leading supply centers . . . the nation-wide network of 92 BOSTON Gear Distributors . . . with stocks totaling $10,000,000.

These are more than advantages . . . they are *essentials* to trouble-free planning and servicing of any product assembled with standardized stock parts. Only BOSTON Gear offers them *all*. Compare — and you'll agree — it pays to "Design around BOSTON Gear."

For advice on speed conversion problems, talk with a specialist, the BOSTON Gear Field Engineer. Ask your BOSTON Gear Distributor to arrange a call, or write: Boston Gear Works, 83 Hayward Street, Quincy 71, Mass.

T-BRONZ Oil-Impregnated ARINGS



Get Catalog No. 55

Industry's most valued "textbook" of drive design and maintenance . . . includes 30 pages of Engineering data.

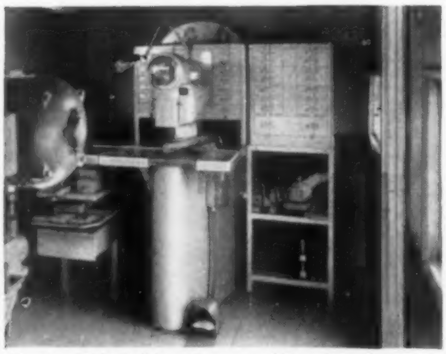
BOSTON Gear®

FOR PROMPT DELIVERIES AT FACTORY PRICES

ALL EARINGS

Look under "Gears" in the Yellow Classified Section of your Telephone Directory for the BOSTON Gear Distributor nearest you.

Put the WALES Fabricator through its paces at your plant!



Showing *Wales Fabricator* in new mobile unit for demonstration at your plant. See it operate at your plant before you buy any other type of hole punching, notching or nibbling equipment.

Showing Wales *Tru-Edge Shear* for circle and shaped cutting, beading and forming in the new mobile unit. Material is sheared, not punched.

Above new Wales-Strippit mobile unit (1 of 3) brings the Wales Fabricator right to your plant. You and other plant executives can use this unique Wales Fabricator to produce your own parts. Your time study men can evaluate its astounding money-savings, cost-saving efficiencies.

The Wales Fabricator is the only machine of its kind and is designed for rapid interchangeability for punching, notching and nibbling. Work from blueprints or operation sheets . . . no *templates required.* Can you match the Wales Fabricator time studies below?

See for yourself. Operate it. Put it through its paces. Write today for Wales Catalog 10-AA and an appointment for a demonstration at your plant.

An electronic chassis, 12½" x 11½" with 118 holes and 4 notches was completed including setup in only 32.45 minutes and subsequent pieces in only . . . . **6.44 MIN.**

A part of a piece of farm equipment 72½" x 22" with 32 holes and nibbled cut-out was finished including setup in only 12.01 minutes, subsequent pieces in only . . **2.32 MIN.**

WALES-STRIPPIT CORPORATION

GEORGE F WALES, *Chairman*

393 PAYNE AVE., NORTH TONAWANDA, N. Y.

(Between Buffalo and Niagara Falls)

WALES-STRIPPIT OF CANADA LTD., HAMILTON, ONTARIO

Specialists in Punching and Notching Equipment

OK MILLING CUTTERS IN THE AIRCRAFT INDUSTRY—NO. 8

OK milling cutters hogmills centerslot of counterweight forging for world's most powerful piston aircraft engine

Great advancements have been made in the art of milling metal in recent years, especially in the aircraft industry. And, no where is this better exemplified than at the new Pratt & Whitney Aircraft plant at North Haven. Here, everything is ideal. Ample room for every operation. Hundreds of milling machines, all kinds, sizes. Thousands of metals cutting tools. Here, you get a realistic definition of the meaning of close tolerances.

In the illustration, an OK face mill is rough-milling a slot 3/16 x 8″ in a tough steel forging for a counterweight used in the Wasp Major engine.

OK milling cutters are favorites of the aircraft industry—engine builders, frame manufacturers, component part makers. OK cutters have more beef in the body, are heavier size for size. Blades once driven home, sit secure, unmovable. Mated serrations prevent side-sway and form an accurate measurement for blade advancement to compensate for wear. Mills with this fine adjustment feature reduce grinding to less than .005″ per blade.

OK MILLING CUTTER ON A MILWAUKEE VERTICAL SEMI FINISH—MILLS SLOT OF A TOUGH AIRCRAFT STEEL FORGING AT NEW PRATT & WHITNEY AIRCRAFT PLANT, NORTH HAVEN, CONNECTICUT.

Write for OK Tool Catalogs

"MODERN MILLING CUTTERS FOR MODERN MILLING MACHINES"
"AMERICA'S FIRST SYSTEM OF SINGLE POINT TOOLS"

TWO COMPONENTS—BODY AND BLADES

SIMPLE . . .

STRONG . . .

SUFFICIENT . . .

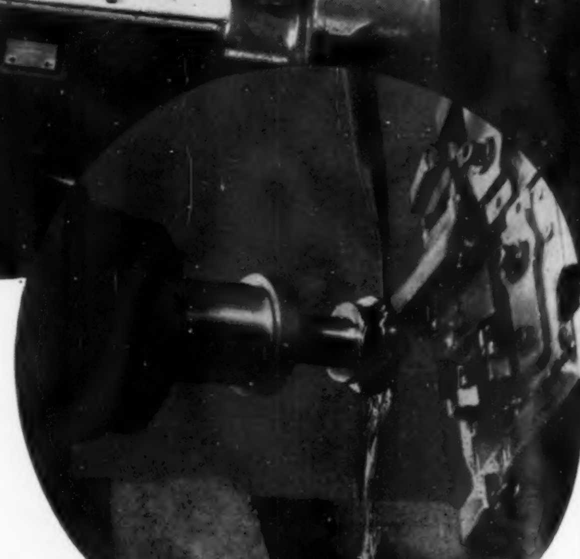
OK

modern milling cutters for modern milling machines

THE OK TOOL COMPANY INC. Milford, New Hampshire

careful testing proved SUPERIORITY of

GULF LASUPAR



Mr. Raymond St. John, inspector, and a Gulf Sales Engineer discuss results with Gulf Lasupar Cutting Oil in machining bevel gears.

A close-up view of bevel gear cutting, showing Gulf Lasupar Cutting Oil in action.

CUTTING OIL

for every cutting operation at Belock Instrument Company, Long Island, New York

Belock wanted a cutting oil that would produce precision instrument parts to extremely close tolerances, and give an excellent surface finish with as few tool changes as possible.

After careful tests, using many kinds of cutting fluids, they found that Gulf Lasupar Cutting Oil gives them better performance over their entire range of machining operations on the many types of steel they process.

In Gulf Lasupar Cutting Oil you get three degrees of sulphur activity, each designed to provide better protection for the tool and to insure a better finish under a given set of machining conditions—(1) extremely active free sulphur held in a stable solution, (2) sulphur combined with mineral oil by a special Gulf process, and (3) sulphur combined with fatty oil.

A Gulf Sales Engineer will be glad to demonstrate the advantages of Gulf Lasupar Cutting Oil in your plant. You will find him always "on call" at your nearest Gulf office.

A Bechler Swiss Automatic Screw Machine Cutting A.I.S.I. 416 Stainless Steel. These Gear Blanks are held to tolerances of .0003 of an inch.

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GULF REFINING COMPANY
1822 GULF BUILDING
PITTSBURGH 30, PA.

GULF SERVES INDUSTRY

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January 31-
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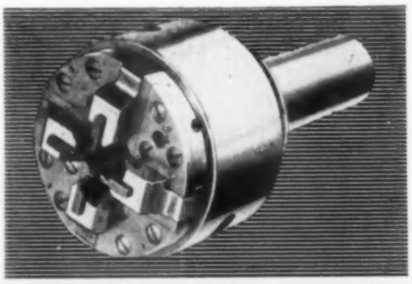
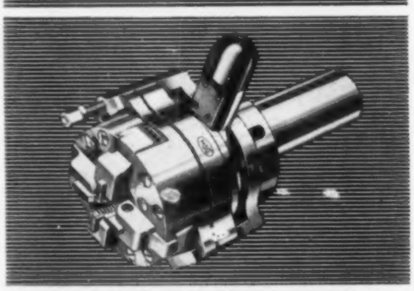
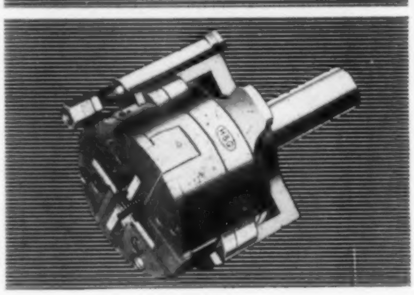
An IDLE *man at a* BUSY *automatic spells* PROFIT. ¶ *A* BUSY *man at an* IDLE *machine spells* LOSS. ¶ *H & G Insert Chaser Die Heads are preferred by screw machine engineers because they spell less down time, lower costs, cleaner, more accurate threads.*



Style MM
for multiple spindle automatics, chucking machines, drill presses.



Style DMS
for hand screw machines, turret lathes, where die head does not rotate.



Style DM
for B & S automatics and small spindle machines.

H&G Insert Chaser DIE HEADS

WRITE FOR "HOW TO SELECT THE PROPER DIE HEAD FOR THE JOB".

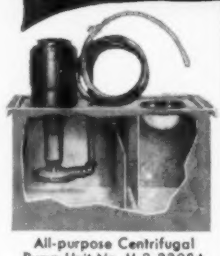
THE EASTERN MACHINE SCREW CORPORATION

27-47 Barclay Street, New Haven, Conn.

USE READER SERVICE CARD; INDICATE A-2-272-1

See how GRAYMILLS Coolant Pumps can help you

- **convert to wet cutting**
- **or**
- **replace worn out pumps**



All-purpose Centrifugal Pump Unit No. H-2-3308A for 90% of machine tool applications

Gear Pump Unit No. SG1-4-25A Ideal for single spindle drill presses and small lathes

in a matter of minutes for increased production—improved quality — and longer tool life with your present machine tools.

If you need a larger volume of coolant, cutting oils, water, solvents, etc., at low pressures, the new improved Graymills Centrifugal coolant pumps are your answer. If you need higher pressures, for heavier liquids, a Graymills Gear type pumping unit will deliver from 1 to 3 GPM with pressures up to 100 PSI. Both types will give longer trouble-free service, efficient operation at a minimum of cost. Standard models in 1/25, 1/8, 1/4 and 1/2 H.P. Various tank sizes and fittings.

All standard models stocked by leading Industrial Supply Distributors for immediate delivery — or write for catalog.

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GRAYMILLS CORPORATION

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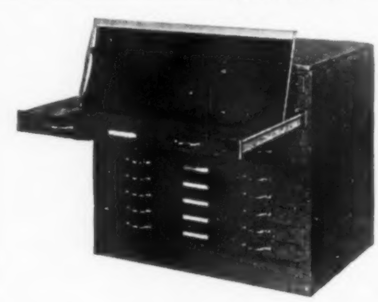
MAYLINE



MAYLINE Metal Plan Files

Attractive office gray finish—Hinged Dust Cover—Color of cover matches cabinet—5-drawer units stack securely.

Plan Files available in 3 sizes. Choice of Sanitary or Flush base. Drawer partitions and locks optional equipment.

For your requirements, try Mayline. See your local dealer.

MAYLINE

MAYLINE

MAYLINE COMPANY

formerly ENGINEERING MFG. CO.

611 NO. COMMERCE ST. • SHEBOYGAN, WIS.

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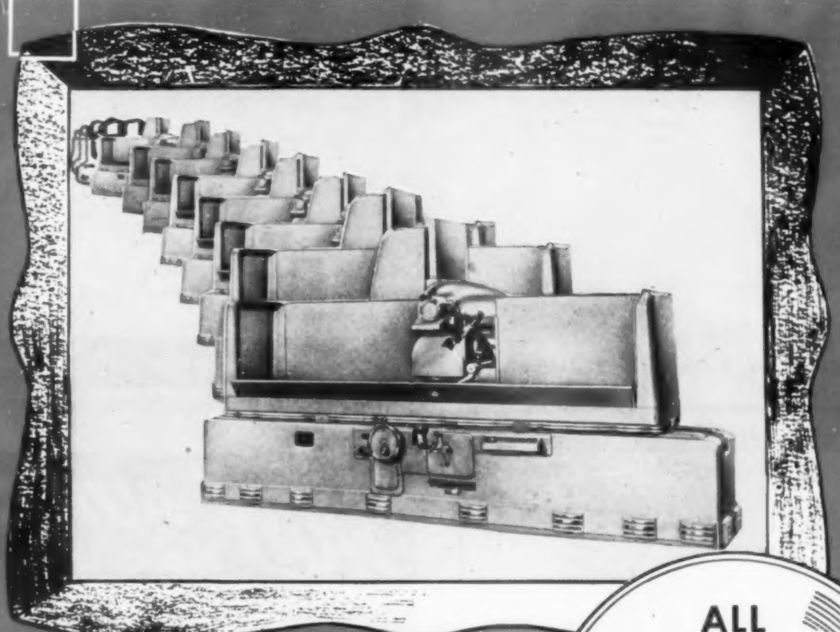
LOOK CLOSELY AT THIS PICTURE
OF GRINDER PRODUCTION AND SEE WHY...

14 is a lucky number

for a manufacturer requiring precision grinding



ALL
Thompsons
operated continuously
with much
LESS
DOWNTIME

After twelve years continuous manufacture of precision ground products, ten Thompson Surface Grinders proved so efficient and economical that this manufacturer ordered four more machines.

Thompson Grinders are available in a wide range of types and sizes from 6" x 18" to 72" x 384" to meet all production, special or tool room grinding requirements. The Thompson line includes machines from giant Hydrial Way Grinders to automatic Truform Jet Blade Contour Grinders, Dual Rotary Grinders and Broach Grinders.

that's why
it will pay you
to invest in

Thompson Grinders

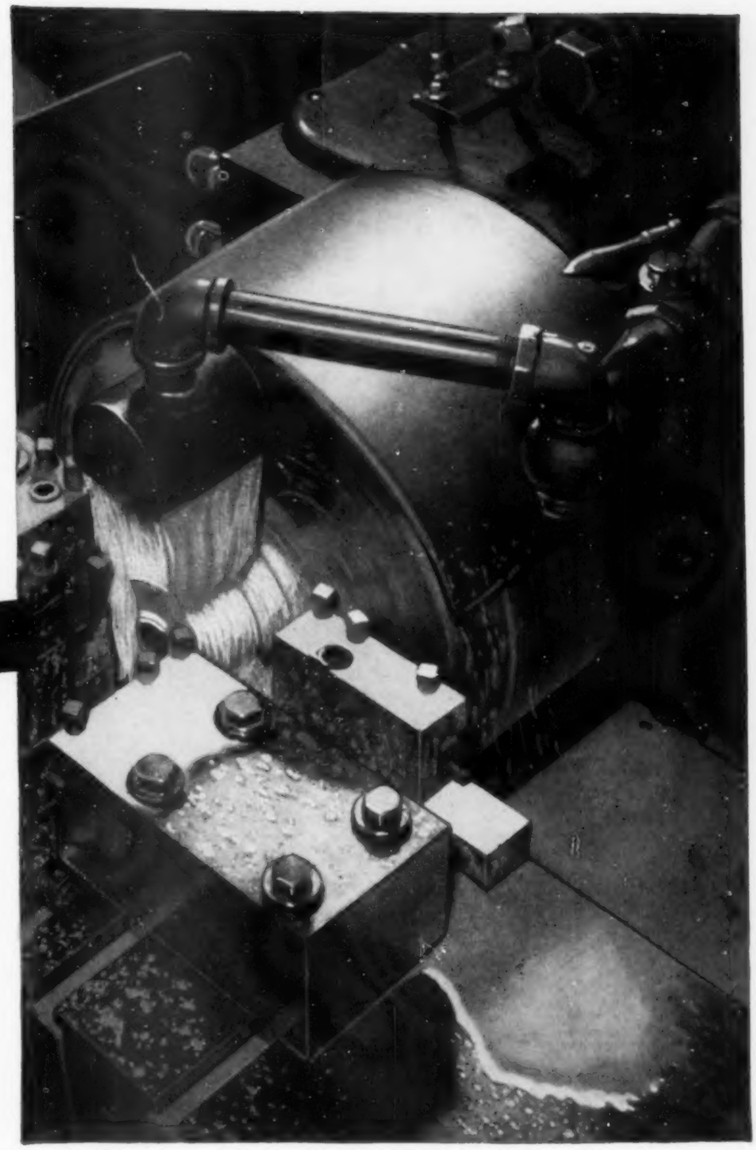
CONTACT THOMPSON TODAY FOR HELP WITH YOUR MACHINING PROBLEMS

THE THOMPSON GRINDER COMPANY
Springfield, Ohio

YOU BE THE JUDGE FOR

DASCO

SUPER SOLUBLE BASE



THE trial of Dasco in many plants has led to this judgment: Dasco Super Soluble Base is a heavy duty water-mix cutting fluid base of unusual versatility. It gives superior performance in mixtures of 1-40 and higher for turning, boring, reaming, drilling and milling and 1-100 and higher for grinding. Only unusual operations may require richer mixtures

TRIAL 1 OPERATION: Turning complete O. D. Nozzle insert for Rockets, B1117 steel

Dasco Performance: One part Dasco Super Soluble Base and 75 parts water on chucking machines increased tool life approximately 35%. Production increased from 50 to 400 pieces in 8 hours. Tool changes decreased from 27 tools per 8 hours using a competitive soluble oil to 12 tools per 8 hours with Dasco Super Soluble Base.

TRIAL 2 OPERATION: Drilling, counterboring and reaming 90MM Projectiles, A.I.S.I. 1055 forgings

Dasco Performance: Number of pieces per set of tools averaged 250 for a rich mixture of competitive heavy duty soluble oil. A 1-20 mixture of Dasco Super Soluble Base produced 500 pieces per set of tools.

TRIAL 3 OPERATION: Internal grinding of steel ring
Machine: Bryant Internal Grinder

Dasco Performance: A 1-150 mixture of Dasco Super Soluble Base replaced a 1-80 mixture of a competitive soluble oil. In addition the competitive product required a rust preventative. Dasco, even at the long dilution, has been in the machine over a month: no rusting has been experienced.

More Than a "Coolant" is Needed

D.A. Stuart Oil CO.
EST. 1865 LIMITED

TIME-TESTED CUTTING FLUIDS AND LUBRICANTS
2727-49 S. Troy St., Chicago 23, Illinois

In Canada: R. W. Horsey Canada, Ltd.
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Check One: ☐ Have Stuart Representative Call
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it pays up to 50% to think

FIRST

about last operations

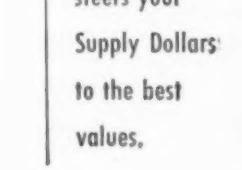
Parker-Kalon Self-tapping Screws have been cutting assembly costs of millions of metal and plastic products for over 35 years. Yet, today, thousands of manufacturers, who could gain the same benefits, still use such slow-down fastening methods as machine screws in tapped holes, bolting, and riveting. Why?

The reason is that too many product engineers think *last* about assembly because it is a final operation, then follow habit or custom in specifying fasteners.

Best way to make sure of savings you have been missing is to think *first* about fastenings . . . compare methods for simplicity, speed and security. Records show that in 7 out of 10 cases, P-K Self-tapping Screws show substantial savings, often up to 50% and more.

A P-K Assembly Engineer will help you get the facts you need. He'll call at your request. Parker-Kalon Division, General American Transportation Corporation, 200 Varick Street, New York 14.

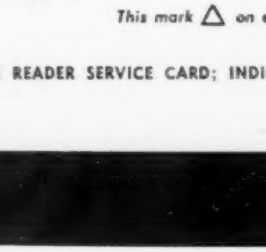
P-K Type A
— *the FIRST Self-tapping Screw*



The INDUSTRIAL DISTRIBUTOR steers your Supply Dollars to the best values.

PARKER-KALON®

The Original **SELF-TAPPING SCREWS**

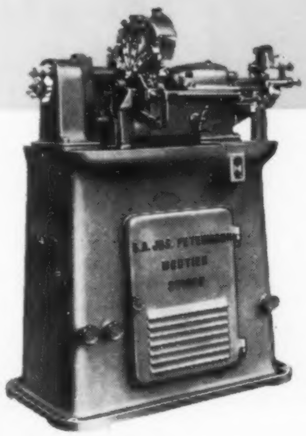


GET THIS GUIDE TO LOWER ASSEMBLY COST

Filled with facts you need to plan for lowest cost when you plan assemblies. Ask your P-K Distributor, or write Parker-Kalon for Form 475-D.

This mark △ on every P-K Self-tapping Screw identifies it as genuine.

THE LITTLE GIANT OF THE PETERMANN FAMILY



For work within its capacity (pieces $\frac{5}{32}$" in diameter and 1½" long) we offer a machine of 'deadly' accuracy and high production . . . 10 speeds to 12,000 RPM.

The P-4 AUTOMATIC

On this page we can show only *one* of the P-4's salient advantages . . . the ability to remove a tool for sharpening without removing it from the tool holder . . . *and grinding in place.*

The many other advantages are described in Catalog sent on request.

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.

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IF You Make Blanking, Piercing or Stamping Dies—

THEN The Cerromatrix Method of Punch and Die Setting can Save You Money because:

Construction time is reduced—as much as 500 hours of expensive labor time on complicated dies.

Die life is increased—longer punches can be used in certain types of dies.

Greater accuracy in locating parts *after* hardening is permitted.

Start Saving by writing now for Bulletin A-15 containing full directions for use.

See our Exhibition ASTE Exposition Philadelphia, April 26-30 incl.

CERRO DE PASCO CORPORATION

C DE P ®

Dept. 3, 40 Austin St., New York 5, N. Y.

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a handful of precision!!

- **GREATER ACCURACY**
- **EASIER READING**
- **FASTER OPERATION**

for . . .

Thread Reliefs
"O" Ring Grooves
Snap Ring Grooves

Ranges Available from .300" to 6.000"
Inreach to 30"

RIMAT INTERNAL GROOVE GAGES

. . . the ORIGINAL indicator gage designed for measurement of internal groove diameters. POSITIVE ACCURACY assured with readings to less than ± .0001". LARGE 2" INDICATOR DIAL for faster, easier readings. SIMPLE SETTING with outside micrometer or gage blocks. LIGHTWEIGHT for fatigueless, day-long operation. Truly, a handful of precision!

Write for full information TODAY!

RIMAT TOOL COMPANY
Dept. TE-2
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PASADENA 2 • CALIFORNIA

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Improve Your Operating Efficienc Quality and Profits with these LAST WORD Metal-Working Produc s!

Model A
Model B
Model C

LAST WORD WHEEL DRESSERS FOR RADIUS AND TANGENT ANGLE DRESSING — AVAILABLE IN 3 MODELS
MODEL A—For grinders using wheels up to 20" dia MODEL B—For small model surface grinders with 7' max wheel dia MODEL C—Compound Dresser, will compensate for compound angles involved in grinding form tools.

SAMSON "Heavy-Duty" OFFSET BORING CHUCK—Has positive centering feature for drilling and milling operations. Complete accessories available

GRAY-GRIMES FLOATING DRIVER—For reaming, tapping, valve seating and similar operations. Can be supplied with standard or special shanks and adaptors.

GRAY-GRIMES AUTOMATIC STEADY-REST FOR O. D GRINDING—Permits grinding complete length of shaft maintaining constant pressure against work-piece as stock is removed.

Send for complete data

Mfg'd by Gray-Grimes Tool Co.

LAST WORD sales company
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People work better when they SEE BETTER

MAGNI-FOCUSER

SPEEDS PRODUCTION

Leaves both hands free to work

3-D Girl at SKF

Magni-Focuser multiplies the power of this girl's eyes as she inspects a tiny ball bearing at SKF Industries, Inc.

Magni-Focuser—the binocular magnifier — reduces eye-strain and ***prevents squinting*** —thereby speeding production, increasing accuracy and minimizing the chance of errors and accidents.

Gauge reading, layout work, inspection, tool and die work are just a few of the jobs that need the Magni-Focuser. Speeds precision assemblies, blue print work. Restores the usefulness of the skilled hands of many older workers whose vision needs a seeing aid.

Magni-Focuser's matched prismatic lenses give needle-sharp magnification. Comfortably light weight. Fits over regular glasses. Leaves both hands free. Normal vision may be resumed by lifting head.

Magni-Focuser can help your plant produce better. Immediate delivery. 10-day trial without obligation. Return to us if not satisfied. $10.50.

Gives true third-dimensional ("3-D") vision

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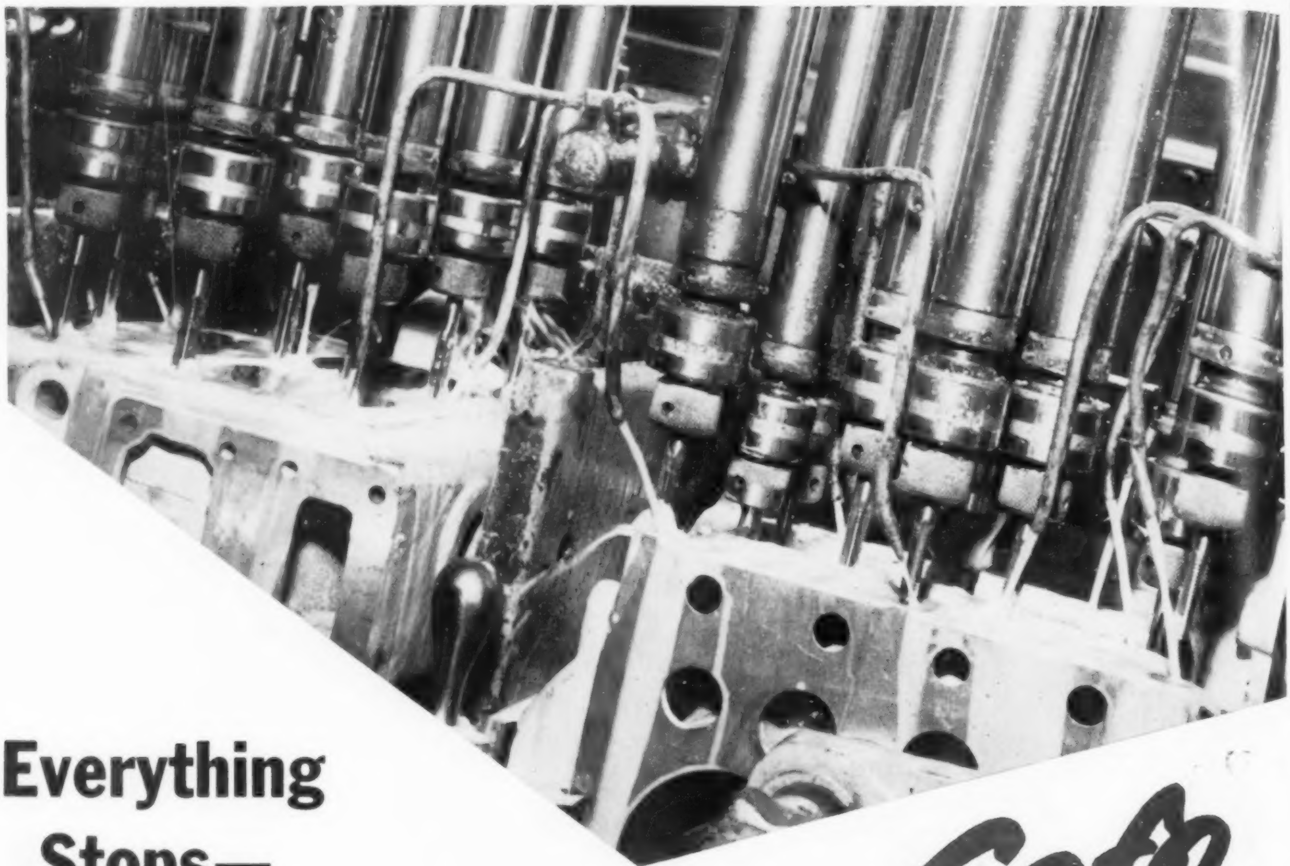


Everything Stops— If One Tap Fails!

Play Safe

Specify BESLY TAPS

You don't take a chance when you use Besly Taps in your multiple tapping operations because you can be sure of uniform threads and long, dependable tap life. There's less expensive down-time to change taps; material and labor isn't wasted because holes are being improperly tapped.

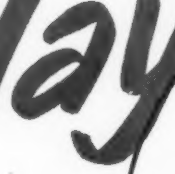
LET US PROVE TO YOU . . .

that Besly Taps can give you better tapped holes . . . for a longer time on *any* tapping operation. Ask for a free TRIAL RUN on your toughest jobs and see for yourself what Besly Taps can do.

UNSURPASSED ACCURACY AT ALL VITAL POINTS

- Microcentric CHAMFER
- Accurate RAKE ANGLE
- Solid-Ground THREAD FORM
- Mirror-finish FLUTES
- Tru-Square DRIVER

BESLY-WELLES CORPORATION
Established as Charles H. Besly & Co. in 1875
Dearborn Ave., Beloit, Wisconsin



TAP TIPS The handy "Handbook for Tap Users" is full of information on tapping methods and tap selection. WRITE FOR YOUR FREE COPY.

BESLY Drills, Reamers and End Mills—High-Speed Cutting Tools in a complete range of types and sizes.

LOGAN . . . a national participant in major fluid power advancements

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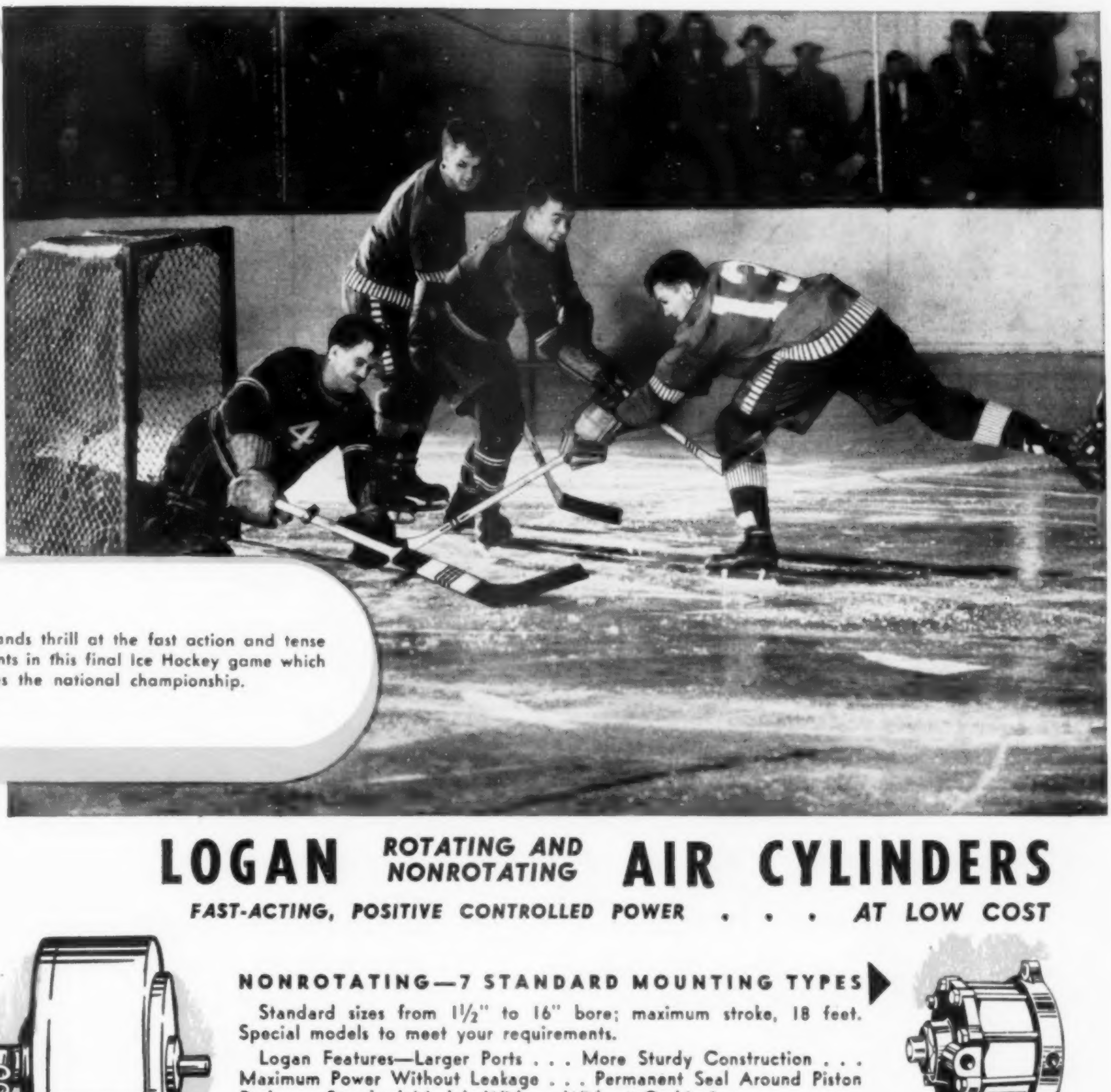
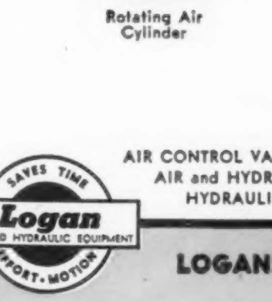


Thousands thrill at the fast action and tense moments in this final Ice Hockey game which decides the national championship.

LOGAN ROTATING AND NONROTATING AIR CYLINDERS

FAST-ACTING, POSITIVE CONTROLLED POWER . . . AT LOW COST



Rotating Air Cylinder

NONROTATING—7 STANDARD MOUNTING TYPES

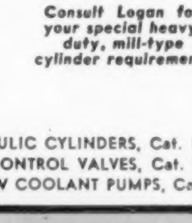
Standard sizes from 1½" to 16" bore; maximum stroke, 18 feet. Special models to meet your requirements.

Logan Features—Larger Ports . . . More Sturdy Construction . . . Maximum Power Without Leakage . . . Permanent Seal Around Piston Rod . . . Standard Models With or Without Cushioning.

ROTATING

Two Standard Styles—Type R with cast iron body; Type K with lightweight aluminum body.

Bore diameter 1½" to 20"; piston stroke 1" to 2"; longer strokes available as special. American Standard adaptations.



Nonrotating Double-Acting Air Cylinder

Consult Logan for your special heavy-duty, mill-type cylinder requirements

LOGAN MANUFACTURES 6,975 STANDARD CATALOGED ITEMS

FREE CATALOG ON REQUEST

AIR CONTROL VALVES, Cat. 100-4 · AIR CHUCKS, Cat. 70-1 · AIR CYLINDERS, Cat. 100-1 · AIR-DRAULIC CYLINDERS, Cat. 100-3 · AIR and HYDRAULIC PRESSES, Cat. 51 · COLLET GRIP TUBE FITTINGS, Cat. 200-5 · HYDRAULIC CONTROL VALVES, Cat. 200-4 · HYDRAULIC CYLINDERS, Cats. 200-2; 200-3 · HYDRAULIC POWER UNITS, Cat. 200-1 · SURE-FLOW COOLANT PUMPS, Cat. 62

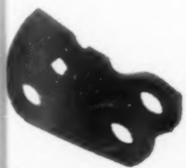
SAVES TIME · Logan · AIR AND HYDRAULIC EQUIPMENT · EFFORT · MOTION

LOGANSPORT MACHINE CO., INC., 839 CENTER AVE., LOGANSPORT, IND.

"Internal ring gear being hardened on the Lindberg LI-25 Induction Heating Unit".

Investigate the amazing versatility of the Lindberg Induction Heating Unit—approximately 2000 different parts have been selectively hardened or annealed on this typical commercial heat treating installation.

FROM THE LARGEST—The internal ring gear illustrated above—with a 60" inside diameter, 3½" face with 187 teeth each individually heated and oil spray quenched.



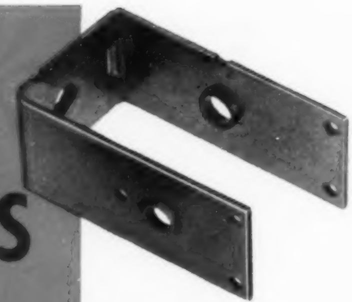
TO THE SMALLEST—This small 2" stamped metal rocker arm was selectively heated and water quenched on the small square face at the rate of 3000 per hour. Investigate this versatile Lindberg Induction Heating Unit—it may supply the answer to your selective heating operations.

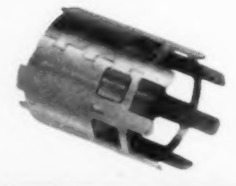
SPECIFY LINDBERG
for any heat treating or melting need! Lindberg manufactures every type and many sizes of melting and heat treating furnaces from tiny laboratory units to mammoth field erected installations—whether it's gas, oil, electric, arc, low or high frequency—consult your local Lindberg Office!

LINDBERG
HIGH FREQUENCY DIVISION

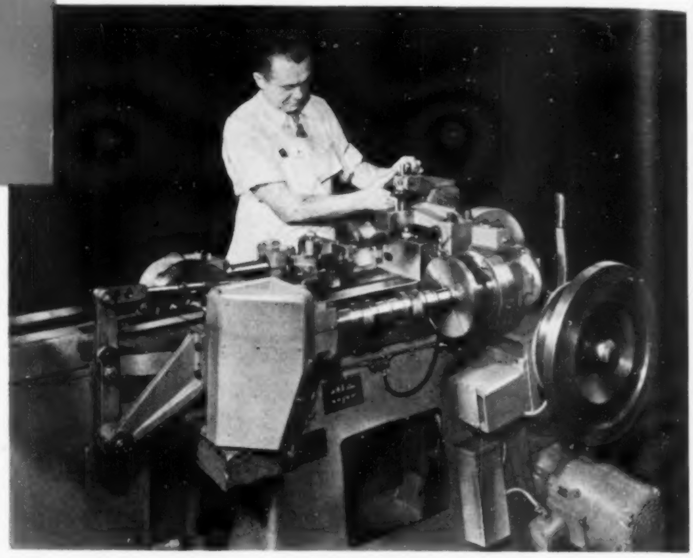
LINDBERG ENGINEERING COMPANY, 2447 W. Hubbard Street, Chicago 12, Illinois

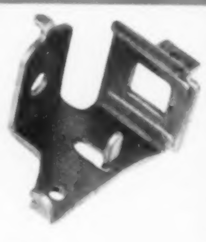
YOU CAN PRODUCE PARTS LIKE THESE ON THE U.S. MULTI-SLIDE®





U. S. Multi-Slide being tooled up at our plant prior to shipment. U. S. Multi-Slide Machines, when sold with tooling, are tested in actual production on your part and with your stock before being shipped.





Top of the bed of a No. 28 U. S. Multi-Slide Machine, with the operator making adjustments to the stock guides. Forming slides and vertical stripper movement, standard equipment on the machine, are shown at right in the photo.

Bulletin 15-T contains complete specifications for all four sizes of U. S. Multi-Slide Machines. Ask for a copy.

All the parts shown here were tooled for production in U. S. Multi-Slide® Machines by the General Tool and Engineering Company, Dayton, Ohio. They illustrate just a few of the many different types of parts which can be produced complete in the U. S. Multi-Slide — without secondary handlings and at profitable high production rates.

The feed unit, ram, forming slides and vertical stripper (which are included as standard equipment) make it possible to produce complete parts of complicated nature to close tolerances at each stroke of the machine. The U. S. Multi-Slide may be tooled up to perform trimming, piercing, shearing, embossing, swaging and forming operations in a great variety of combinations.

You, too, can reduce labor costs, increase production and improve quality by using U. S. Multi-Slides for the production of your precision formed stampings.

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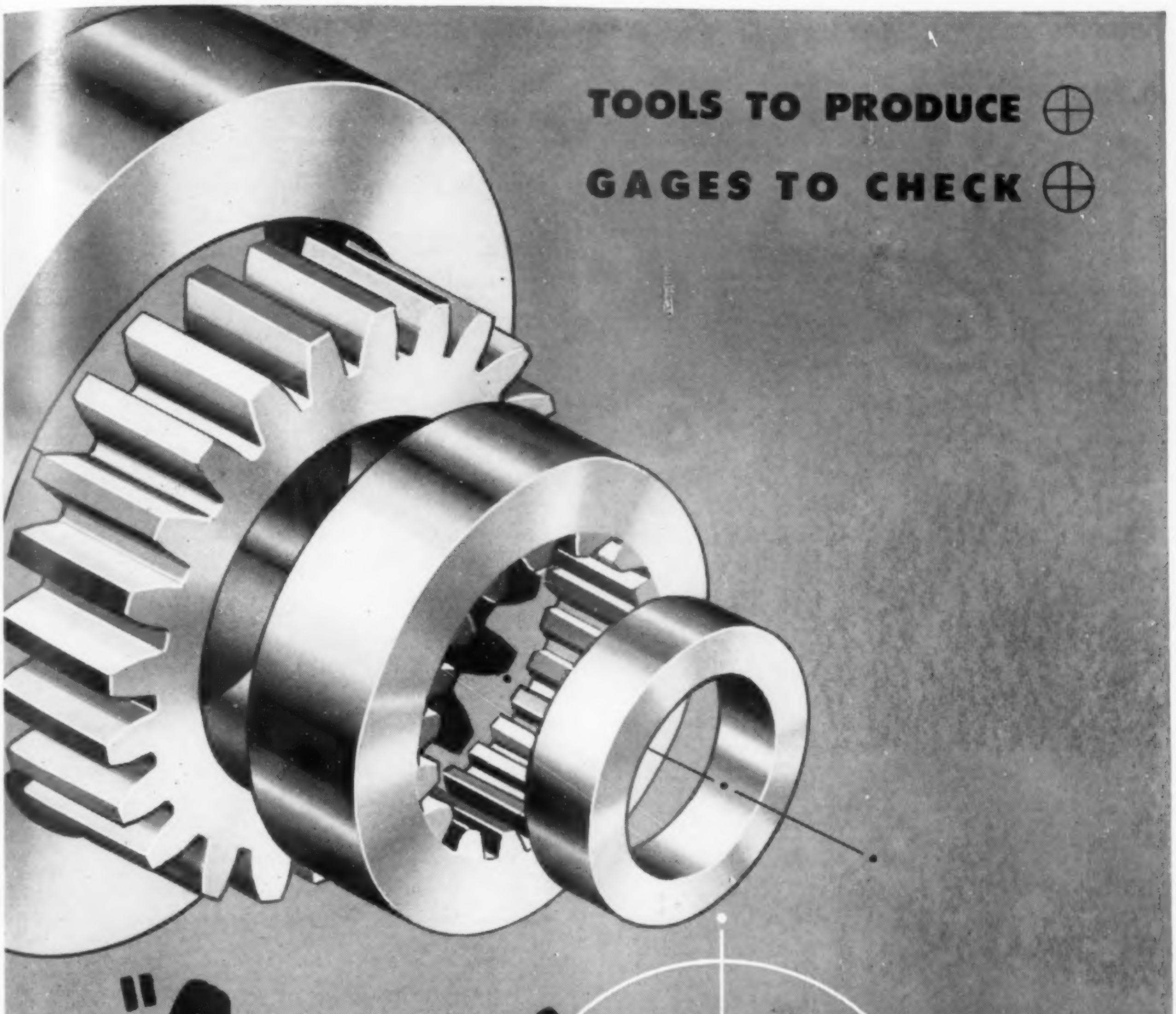
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February, 1954

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